

INTERIM MEASURES – FINAL REPORT

Kanawha River Bank Stabilization and Residue Cleanup Flexsys Nitro Plant Facility, MP 42.1 Nitro, West Virginia

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POTESTA

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INTERIM MEASURES– FINAL REPORT

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1.0 INTRODUCTION AND PURPOSE

This report presents a summary of recently completed work by Solutia, Inc. (Solutia) and associated contractors/consultants related to the Kanawha River Bank Stabilization and Residue Cleanup Project. This report has been prepared and is presented pursuant to Section E.2; Interim Measures of the current Resource Conservation and Recovery Act (RCRA) Corrective Action permit (EPA ID. No. WVD039990965) for the Flexsys L.P. Facility (Plant) located in Nitro, West Virginia. The area of concern is located along the eastern bank of the Kanawha River (M.P. 42.1) outside the fenced limits of the Plant facility.

Initial inspection of the site was conducted on March 6, 2002 by Messrs. Charles Moses, Perry Casto and Chris Gatens of the West Virginia Division of Environmental Protection (WVDEP) from the river. During this investigation a blackish-brown residue material was discovered in soils within the limits of a surface slough along the riverbank. It was noted that the material had appeared to flow down the bank and had entered the river in at least one location. At the request of the WVDEP and the United States Environmental Protection Agency (USEPA) the residue material was sampled during a site visit conducted on March 15, 2002. Following disclosure of the inspection to Solutia, the USEPA was formally notified in writing on April 15, 2002 of a potential release at the Flexsys facility as per the requirements of the RCRA facility permit.

A formal interim measures work plan was prepared by Solutia and submitted to the USEPA on August 2, 2002 for review, comment and subsequent approval. Several drafts of the work plan document were submitted to the USEPA in response to comments. The final work plan was dated August 2, 2002. The site was also located outside the limits of an adjacent Solid Waste Management Unit (SMWU) referred to as the Past Disposal Area, as described in the current RCRA permit for the facility. The site maps are located in Appendix A, Figures 1 through 4. Also provided is a typical cross section of the project site (see Figure 5). The final report provides background information related to this site and describes the work that was completed in compliance with the current facility RCRA Corrective Action permit. Test results from residue samples collected at the site prior to the development of the work plan revealed the following constituents: aniline, n-nitrosodiphenylamine, methylene chloride, and 2,3,7,8-TCDD. These results were considered in the development of the work plan, health and safety plan, and quality assurance protection plan. The health and safety plan addressed potential site worker exposure concerns from these chemicals. The quality assurance and quality controls were applied to this work as per the Quality Assurance Project Plan associated with this project. The purpose of the performed work was to safely contain the contaminated area, remove the

construction/demolition material from the affected area, and remove the visually impacted residues from the site, resulting in a final regraded stable riverbank.

2.0 GENERAL SITE INFORMATION

2.1 Background Information

The Flexsys chemical production facility is located along the eastern bank of the Kanawha River within the city limits of Nitro in Putnam County, West Virginia. The site is a steeply sloped section of riverbank along the Kanawha River. Historically the site has been utilized for chemical production since the early 1910's. The initial production facility was developed by the United States Government for the production of military munitions during the World War I era between 1918 and 1921. The facility was then purchased by Rubber Services Company, who manufactured chloride, phosphate and phenol compounds. Monsanto Company (Monsanto) purchased the facility in 1929 from Rubber Services Company. Monsanto added the manufacture of flotation agents, pickling inhibitors, anti-oxidants, anti-skinning, wetting agents, and oils to the existing production operations in the 1930s. Monsanto continued to expand operations at the facility and accelerated its growth in the 1940s, including the production of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), 2,4-dimethylphenoxyacetic acid (2,4-D) and sodium trichlorophenoxyacetic acid. A byproduct of the production of the 2,4,5-T herbicide is the creation of 2,3,7,8 tetrachlorodibenzo-para-dioxin (TCDD) that has been found in surface soils within the limits of the Nitro facility. Production of the herbicide 2,4,5-T was initiated at pilot scale during the summer of 1948; plant scale production began in October 1948 in Building 34. As the demand for the herbicide increased during the Vietnam War, a new integrated facility in Building 92 was constructed and came online in August 1963. Production of the herbicide continued until demand for the product eased and production ceased at the site in 1969. Several of the units associated with the production of the herbicide were decontaminated, demolished and buried onsite during the early 1970s. The manufacture of rubber chemicals was initially the majority of the Plant's operation, accounting for about 65 percent of its business. The Plant has diversified over the years, including the aforementioned herbicide production and now produces an animal feed nutrition additive in addition to rubber chemicals including vulcanization accelerators, vulcanization inhibitors and anti-oxidants for miscellaneous rubber products. A variety of raw materials have been used at the facility over the years including inorganic compounds, organic solvents, and other organic compounds.

All production operations, maintenance and facility management of the Nitro plant were transferred to Flexsys, a limited partnership, in 1995. This transfer agreement included the entire site and all of the assets except the improved real estate and certain limited manufacturing assets. The RCRA permit was modified (Class I modification) to reflect the change in permittee status from Monsanto to both Monsanto and Flexsys. In 1997, Monsanto spun off the interest in the Nitro Flexsys facility to Solutia, Inc. Solutia and Flexsys share responsibility for RCRA Corrective Action at the plant.

The plant is currently scheduled for shutdown and unit cleanup beginning in March 2004, followed by the initiation of unit demolition in May 2004. Demolition is scheduled to continue through the summer of 2005, at which time the Waste Water Treatment Plant will be taken out of service. At this point Solutia will assume responsibility for the site.

2.2 Topography and Geologic Setting

The city of Nitro is located in Putnam County in the southwest region of the state on the Allegheny Plateau physiographic province. The site is located upon a prominent alluvial terrace, which has developed along the Kanawha River. The alluvial terrace, upon which the site is located, is typically 20 to 30 feet above the Kanawha River. The site is located on the eastern bank of the river and its topography is relatively flat with a relief of less than 10 feet. The unconsolidated alluvial deposits at the site consist predominantly of sand, silt and clay. Coarse sands and gravel are commonly found near the lower elevations of the alluvial deposit just above shale bedrock. Bedrock underlying the site is encountered at an average depth of 58 feet below the ground surface.

3.0 RESPONSE ACTIVITIES

3.1 Initial Site Visit

Potesta & Associates, Inc. (POTESTA), working on behalf of Solutia, contacted Mr. Chris Gatens, an enforcement inspector for the WVDEP, to arrange a date for the collection of a residue sample for analytical testing. It was decided that Solutia would split samples with the WVDEP during the site visit. A site visit was arranged and conducted on Friday, March 15, 2002. A reconnaissance of the general area of concern revealed that the site is located outside the limits of an adjacent SWMU (Past Disposal Area) and that the riverbank is very steep, approaching a 1H:1V slope. The localized area of concern was centered on a slough or shallow slide near the toe of the existing bank at the water's edge. The river was found to be shallow and gently sloping near the edge of the bank in the immediate vicinity of the affected area, with water depths measured approximately 6 to 8 feet in depth 20 feet from the edge. Much of the failed slide mass had been eroded from the toe along the river's edge and several trees within the limits of the failed slope were leaning into the river. Since a located area of residue had migrated into the river, it was decided to retrieve sediment coring samples from this area to find the nature and extent of the residue material.

3.2 Sediment Core Sampling

The fieldwork was conducted on June 9, 2002 near the toe of the existing slide/slough area of the Kanawha River bank. The core sampling was conducted by Doug Bowe and Tony Shaffer of POTESTA; they were accompanied by Mr. Paul Gebhard, a representative of the WVDEP Office of Environmental Remediation. A total of 18 sediment core samples were collected with recoveries ranging from 3.75 to 19.75 inches. The sample points were oriented in three transects, each made up of six individual sediment sample locations (see Figure 4). The first

transect was located in the river approximately 8 feet from the water's edge, the next was advanced 15 feet from the initial transect and the third an additional 15 feet from the second. All of the samples were obtained using a Wildlife Supply Company (Wildco) Stream Sediment Hand Corer. This device is capable of having handles attached in order to retrieve samples from deeper water. The recovered cores were extracted, photographed and visually examined at the site for evidence of tar residue materials. None of the core samples showed any visual signs of residue materials. Photographs of the recovered cores can be viewed in Appendix C.

3.3 Initial Sampling Lab Test Results

The residue samples from the initial site visit that were collected with WVDEP on March 15, 2002, were split between the WVDEP and POTESTA at the site. Both parties submitted samples to REIC Laboratories in Beaver, West Virginia for semi-volatile analysis (method 8270), volatile analysis (method 8260) and 2,3,7,8 TCDD high-resolution dioxin analysis (method 8290). Solutia also submitted an additional split sample to Test America, Inc. of Nashville, Tennessee for the same analyses. An additional sample was also collected and submitted to the in-house Flexsys laboratory for potential source characterization testing. These preliminary results indicated the material was similar in response to the NaMBT pitch, a waste material generated from a long-established production process, which remains in operation at the plant facility. The results of the analyses were as follows:

Item	REIC Labs Results	Test America/PACE Labs
Aniline	150 mg/Kg	N/A
N-Nitrosodiphenylamine	6,970 mg/Kg	5,030 mg/Kg
Methylene Chloride	ND ug/Kg	32.6 ug/Kg
2,3,7,8-TCDD	656 pg/g	550 pg/g

mg/Kg – milligram per kilogram
 ug/Kg – Microgram per kilogram
 pg/g – Picogram per gram
 ng/Kg – Nanogram per kilogram
 N/A – Not applicable
 ND – Not detected

3.4 Site Survey

Upon completion of the initial site visit, POTESTA survey personnel visited the site to complete a detailed topographic survey of the project area. The survey included the approximate location of buried utilities in close proximity to the slide area. The fieldwork was completed on March 27, 2002. The survey was completed utilizing the existing plant horizontal and vertical control and the collected information was reduced to generate the topographic mapping of the area (see Figure 2).

3.5 Work Plan

POTESTA prepared and submitted an Interim Measures Work Plan that presented a proposed approach to provide a remedy to the localized slough/slip along the Kanawha River bank near Mile Point (MP) 42.1. This plan was submitted to the United States Environmental Protection Agency – Region III (EPA) offices for review and comment prior to the initiation of any interim measure efforts by Solutia, Inc. (Solutia) at the site. The proposed interim measures conducted at the site were in compliance with the requirements of the current RCRA Corrective Action permit (EPA ID. No. WVD039990965), pursuant to Section E.2; Interim Measures.

3.6 Award of Contracts

The Flexsys in-house plant contractor at the time of the project, Williams Union Boiler (Williams) of Nitro, West Virginia, was awarded the contract to perform the remediation associated with the project. Maverick Construction Management Company (Maverick), of Auburn, Massachusetts, was awarded the contract for project management responsibilities. Mr. John Fiori of Maverick performed daily management duties at the site.

3.7 Health and Safety Plan

All work conducted at the site was completed under a formal Health and Safety Plan (HASP) which was prepared and submitted under separate cover. The HASP detailed the potential hazards at the work site as well as documenting the PPE requirements for site workers, managers and visitors. All operators, laborers and other site personnel were 40-hour (CFR 1910.120) certified and daily safety meetings were conducted at the site. An exclusion zone was established as described in the HASP and was delineated with yellow caution tape. The contamination reduction zone (CRZ) was established on the platform that had been constructed in association with the site access stairway. All onsite personnel entered and exited the exclusion zone at a single point by utilizing the wooden stairway that led to the bottom of the riverbank. All personnel working in the exclusion zone were in the appropriate level of personal protective equipment. Initially, a Level B PPE status was utilized to limit any possible exposure to personnel in the exclusion zone. The PPE was downgraded to the Modified Level D after the initial ambient air screening tests, conducted during the initial test pit excavation phase of the project, showed that on site ambient air quality was acceptable. Continuous air monitoring and sampling was conducted at the site throughout the project entirety. Work Area air monitoring data, as outlined in Section 8.0 of the HASP, was regularly reviewed for any modifications to the Personal Protection Levels. All disposable PPE was removed by site personnel and placed in drums that had been set up in the CRZ. The PPE containers were sealed and removed for proper disposal after completion of the project. The excavator bucket was decontaminated after the work and the associated waste was contained and properly disposed of after completion of the work.

3.8 Asbestos Abatement

During initial site walkovers of the area of concern, several pieces of potential asbestos containing materials were noticed on the surface of the riverbank. The ground vegetation was removed from the slope to allow the Flexsys plant asbestos abatement contractor, Astar Abatement, Inc. to visually inspect the area of concern for asbestos materials. The abatement contractor removed and bagged collected materials that were evident on the ground surface through visual inspection. Excavation procedures were deferred in the area of concern until the contractor had completed the asbestos abatement procedures.

4.0 CONSTRUCTION SUMMARY

4.1 Site Access and Construction Lay Down Area

Access to the site was established along the river bank on the south side of the slip area. Accessibility to the site for construction equipment required the construction of a new section of the plant perimeter security fencing. The newly constructed section of the fence was fitted with a double swing, 20-foot wide gate that could be locked after daily work activities ceased. This new section of fencing and the locked gate remained to serve as the permanent plant perimeter fence after completion of the work activities. Photographs of the new fence and other construction activities can be found in Appendix C.

Construction equipment entered the site from upstream, parallel to the river. The site access road was stabilized with base stone prior to project startup. The construction of this access corridor prevented the need for crossing the existing process sewer line serving the production areas of the plant. The exclusion zone was delineated with yellow caution tape and a contamination reduction zone was established at the top of the riverbank near a site entry point. The contractor constructed a temporary wooden staircase along the slope extending to the bottom the riverbank at the water's edge. These steps were located within the limits of the exclusion zone and were accessed at the top of the bank through the contamination reduction zone. All equipment, with the exception of a roll-off container truck, was dedicated to the exclusion zone during completion of the site excavation. An approximate 20-foot wide strip along the top of the bank and outside the exclusion zone was designated as a working platform for the excavator. The excavator worked all affected areas of the bank from this platform. This area was also utilized for the temporary staging of the roll-off containers while being filled.

Solutia worked with Flexsys plant personnel to secure an area within the limits of the plant and immediately adjacent to the impacted area of the riverbank to stage the required roll-off containers during periods of non-use. This area was located within the limits of the adjacent gravel-covered solid waste management unit (SWMU) known as the "Past Disposal Area". The containers were restricted to this designated area from the time they were unloaded from the transport truck until a final disposal solution/storage alternative is established.

4.2 Installation of Ruff Water Curtain

A commercially manufactured heavy-duty ruff water or sediment curtain was deployed in the edge of the Kanawha River in the immediate vicinity of the area of concern. The purpose of this device was to prevent soils and sediment from entering the river during the term of the construction efforts. The screen was anchored to the bank both upstream and downstream of the site. The curtain was equipped with a flotation device on top such that the curtain was vertically suspended in the river. The curtain was anchored to the bottom of the river by use of sandbags along its entire length. Slack was left in the curtain between the river bottom anchor and the flotation device to accommodate any fluctuation in the river elevation. The curtain remained anchored in place until the entire scope of work was completed and the resulting disturbed areas were stabilized and reseeded. Photographs of the ruff water curtain are located in Appendix C.

4.3 Test Pit Excavation

A long-reach excavator was utilized to complete the series of nine shallow test pits. These test pits were excavated at strategic points along the slope in an attempt to delineate the size and extent of impacted areas. Each test pit was advanced to a sufficient depth so that native soils were exposed allowing for visual examination of the full extent of the tar residue contamination. The plan view attached as Figure 3 in the Appendices indicates the location and orientation of the test pits. The results of the test pit excavations were utilized to determine the limits of excavation and extent required for erosion and sediment control measures to be installed along the water's edge. Specific attention was paid to discoloration of the underlying soils as well as to the presence of any residue. Prior to initiating any test pit excavations, the WVDEP was contacted to allow for a representative to be present onsite to observe the materials encountered. The disturbed areas associated with each test pit location were promptly covered upon completion with plastic sheeting to prevent erosion and minimize potential exposure until the final removal efforts were initiated. Soil samples were collected from each of the test pits and analyzed for TCL volatiles, semi-volatiles, asbestos as well as the seventeen 2,3,7,8 – chlorine-substituted dioxin and furan congeners. The sample locations and procedures are covered in detail in the attached Sampling and Analysis Plan (SAP), which is considered part of this Interim Measures Work Plan. Test pit sample results are located in the Appendices as Table 1. All personnel working within the limits of the exclusion zone during completion of this work were required to work in Level B PPE. The individual test pit photographs are located in Appendix C.

4.4 Meteorological and Air Monitoring

Meteorological monitoring was conducted in conjunction with the air monitoring. These data were used to determine the air movement and reviewed in preparation for planning the day's activities. The sensors used monitored the temperature, humidity, and the wind speed and direction. Air sampling and monitoring was conducted prior to and during the activities at the site. All monitoring was conducted in accordance with Section 8.0 of the HASP. Background air concentrations of aniline, n-nitrosodiphenylamine, and total VOCs were collected and used to establish a baseline of ambient air concentrations. This baseline was compared to the airborne concentration data taken during the completion of construction activities. These air data were

routinely reviewed to evaluate levels of PPE, need for dust control, and confirmation of the effectiveness of on-site engineering controls. The baseline survey was conducted on August 28 and August 29, 2002. The monitoring locations were determined in the field prior to the sampling baseline upon, but not limited to, the following parameters.

- ◆ Anticipated nearby operations
- ◆ Anticipated future site activities
- ◆ Site accessibility
- ◆ Historic and current weather conditions
- ◆ Location

Permanent air monitoring devices were established at the northern, southern, and eastern edges of the exclusion zones. A handheld device was used to monitor air quality for a time in the immediate vicinity of the work area by Mr. John Fiori, of Maverick. Mr. Fiori entered the site in Level B PPE to secure the work area each day prior to initiating work at the site. Results indicated that the presence, if any, of the VOCs, n-nitrosodiphenylamine, and aniline were all below the detection limits of the equipment in use. Results and tables of the air monitoring can be found in a full report in Appendix D.

4.5 Site Preparation

A reinforced erosion and sediment fence was installed along the edge of the river to prevent loose debris and soil from entering the water during the excavation and removal activities. Prior to and during the installation of the sediment fencing materials, the localized area of residue that had entered the river was excavated and placed directly in 55-gallon drums. These drums were then transferred to the appropriate roll-off containers. Excavation was also conducted in the immediate edge of the river in close proximity to the residue seep so that the potentially contaminated material was excavated and removed. Several large trees existed on the slope adjacent to the slide mass, which aid in slope stability. These trees were marked, and caution was exercised during work to avoid damaging the trees. These trees and their surrounding areas were visually inspected for contaminated soils and residue materials. The inspection revealed no visible trace of contaminants.

4.6 Roll-off Containers

Fourteen Department of Transportation (DOT)-approved 30 cubic yard roll-off containers were inspected and properly labeled prior to the start of the excavation phase of the project. This label included an assigned number prominently displayed on at least two sides of each roll-off. These roll-offs were dedicated for the segregation and storage of three separate waste streams. The assumed waste streams were categorized as follows: tar residue and residue-stained soil, residue-impacted construction/demolition wastes and clean construction/demolition wastes. A color-coding system was employed to designate the type of waste stream to be placed in each roll-off while on-site. The color-code system was as follows: black-50 percent soil/50 percent debris, orange-mostly soil, green-mostly debris. Formal documented checklist forms (provided)

were prepared for each of the roll-offs and were available for inspection on-site at any time. The inspection procedure included a visual examination of the general overall condition of each container including the gate hinges, gaskets and interior walls and floors of the containers. While on-site, roll-off containers were labeled as "Non-Classified Waste Material-Laboratory Analysis in Progress". The containers were appropriately labeled after receipt of the laboratory results. The containers were supplied with bows and tarp covers and were also lined with plastic sheeting prior to loading. These containers remained covered when not in use or during off work hours. After loading, roll-offs were placed in the Past Disposal Area (PDA) area where a construction fence was erected to keep personnel from disturbing the roll-offs.

4.7 Waste Excavation/Removal

Visual observations of the exposed slide scarp indicated that the residue material appeared to be localized in a relatively thin (2"– 4") seam that existing beneath surficial construction demolition materials along the riverbank.

The excavation procedures began with careful removal of the construction/demolition materials existing on the surface of the slope. The excavated materials, which were not stained by the residue material, were placed in the appropriate labeled roll-off container. Those construction/demolition materials, which had been in contact with or had been impacted by the tar residue material, were separated and placed in the appropriately designated roll-off containers.

After excavation and removal of the construction/demolition materials from the surface of the bank, the exposed surface was visually examined for residue materials and discoloration. The excavation then proceeded with the removal of residue and visually impacted materials from the bank. The excavator transferred the tar residue and co-mingled soils to the appropriately labeled roll-off containers. The underlying soil surface was again visually examined to determine if additional stained soil or residue impacted areas existing within the limits of the stabilized and excavated slide area. Once the site personnel agreed that underlying native soils had been encountered along the slope, confirmation sampling then commenced.

4.8 Confirmation Sampling

Confirmation samples of the exposed native soils were collected and tested. The sampling scheme was established by utilizing the PC based computer program, Visual Sampling Plan, version 1.0. Pacific Northwest National Laboratory (PNNL) and Advanced Infrastructure Management Technologies (AIMTech) developed this program for the United States Department of Energy. This program determines the appropriate number and location of samples to provide validity for test results upon which decisions are made. The program provides sample-size equations or algorithms needed by specific statistical tests that are appropriate to meet sampling objectives. The excavated area was sampled using a systematic sampling grid having a 95 percent probability of identifying a hot spot with a radius of 10 feet (see Figure 4). Discrete confirmation samples were analyzed for TCL volatiles, semi-volatiles, asbestos as well as the seventeen 2,3,7,8 – chlorine-substituted dioxin and furan congeners. The results were compared

for screening purposes to the EPA Risk-Based Concentration (RBC) Tables for residential exposure limits. The results were collected to provide readily available information for future consideration and study during the screening phase of future RCRA actions associated with the adjacent SWMU's. Analytical results are located in Appendix B as Table 2.

4.9 Waste Disposal/Storage

All three waste streams, which were segregated, collected and contained in the individual roll-offs, were characterized by collecting a composite sample from each container. A composite sample was collected from the four corner locations and the middle of each roll-off. Samples were collected from the top, middle and bottom of each core. Results from these tests are given in tabular form in Table 3. The resulting composite samples were analyzed by REI Consultants, Inc. (REIC). The following laboratory methods were used by REIC: EPA methods 8260C, 8270C, 1613B, and EPA/600/R-93-116. The roll-offs are located within the limits of the past disposal area of the SWMU Flexsys plant properties.

4.10 Decontamination Procedures

Decontamination procedures were followed upon completion of excavation and stabilization activities including all confirmation sampling, roll-off characterization sampling, site worker exit from the site through the contamination reduction zone, and equipment decontamination. Sampling procedures conducted during both the confirmation sampling and roll-off characterization procedures utilized new, sealed disposable sampling scoops and laboratory supplied sampling bottles. When non-disposable sampling equipment was used at the site, it was decontaminated between individual sample collection events as follows:

- ◆ Washed with a non-phosphate biodegradable detergent and water solution
- ◆ Rinsed with distilled water
- ◆ Final rinse with distilled water

Specific detail and standard decontamination procedures that were followed during the sampling efforts at the site were included in the Sampling and Analysis Plan that was developed for this project.

4.11 Daily Field Activity Logs

Field logs were kept at the site on a daily basis by Mr. Dave Corsaro of POTESTA. The field logs indicate activities that occurred over the duration of the project. Type-written versions of the field logs are attached in Appendix C.

4.12 Site Stabilization and Reseeding

Immediately after completion of the confirmation testing, a geotextile fabric was placed on the face of the bank in the work area. The excavator was utilized to place riprap and stone backfill on top of the fabric. The disturbed areas above the riprap along the top edge of the bank were

seeded and mulched. Immediately following completion of the bank stabilization and seed activities, the heavy-duty ruff water screen was removed from the river and disposed of in one of the roll-offs. Once vegetation has been established on the disturbed portions of the slope, the silt fencing will be removed from the site.

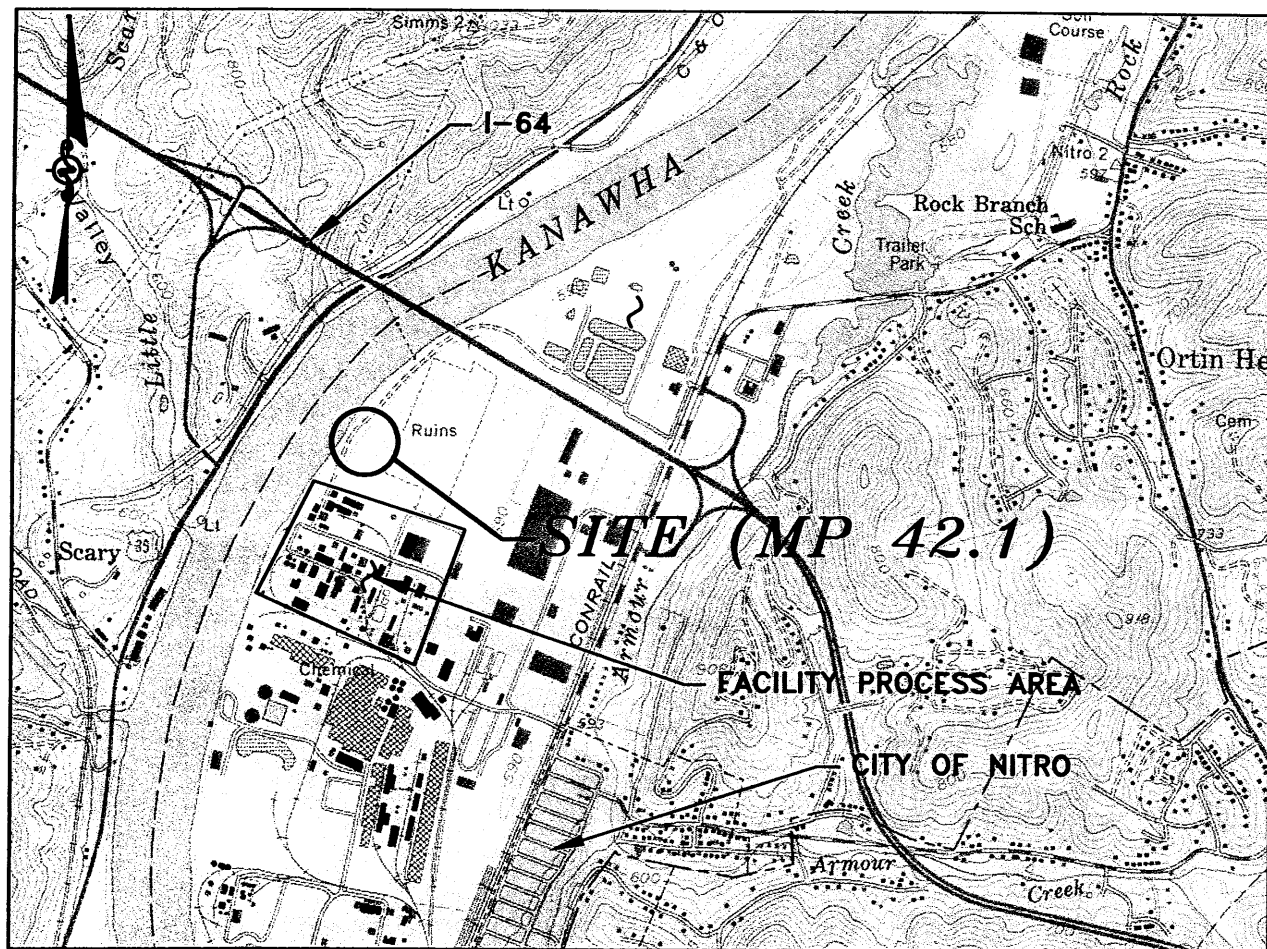
5.0 LABORATORY AND DATA VALIDATION SUMMARIES

Sample analysis was conducted by REI Consultants, Inc. (REIC) of Beaver, West Virginia for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) by USEPA SW-846 Methods 8260B and 8270C respectively. Dioxin/furan (USEPA Method 1613B) analysis was subcontracted to Triangle Laboratories, Inc. of Durham, North Carolina. REICs laboratory summary sheets can be viewed in Appendix F. Also, as requested by the USEPA, laboratory analytical data was 100 percent validated at the M3 level by a party other than the laboratory itself. Mr. John W. McDonald from POTESTA preformed the data validation process. The data validation summaries are located in Appendix F.

6.0 CLOSING

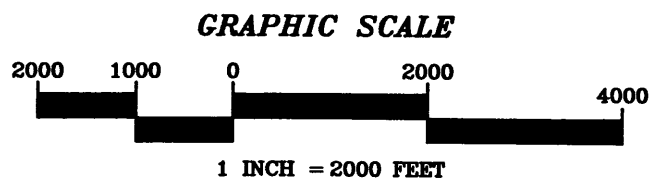
This Final Report has been prepared pursuant to Section E.2; Interim Measures of the current Resource Conservation and Recovery Act (RCRA) Corrective Action permit (EPA ID. No. WVD039990965) by POTESTA, working under contract to the Respondent Solutia. This report addresses the tasks required by the approved work plan and explains the method tasks which were performed to meet the requirements set forth in the interim measures work plan. The tasks performed in order to achieve this Final Report include various submittals, sampling procedures, testing methods, QA/QC monitoring, laboratory qualifications, and other techniques issued under the work plan. This Final Report is to aid the EPA in determining that all requirements set forth by the interim measure tasks were fully performed in accordance with the EPA standards.

APPENDIX A



SITE LOCATION MAP

QUADRANGLE: SAINT ALBANS
USGS 7.5" SERIES
TOPOGRAPHIC MAP
PHOTOREVISED: YEAR_1976



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Project

**BANK STABILIZATION FINAL REPORT
FLEXSYS AMERICA LP. PLANT
NITRO, WEST VIRGINIA**

Scale 1"=2000'

Date MARCH 2003

Dwg. No.

FIGURE 1

GRAPHIC SCALE



N 528000

1 INCH = 100 FEET

KANAWHA RIVER
(PROJECTED POOL WINFIELD DAM ELEV. 566.0')

SEE FIGURE 3

N 525750

PROPOSED 20' BI-FOLD GATE

SITE ACCESS CORRIDOR

PLANT SECURITY FENCING

ACCESS ROAD TO WNTU

PLANT PROCESS SEWERLINE

PROJECT TRAILER

APPROXIMATE LIMITS OF "PAST DISPOSAL AREA" SWMU

AREA OF EXCAVATED/REMOVAL MATERIAL STAGING AREA

RELOCATED PERIMETER SECURITY FENCING LOCATION

SLIDE AREA

LIMITS OF PROPOSED LAYDOWN AND ROLL-OFF STORAGE AREA

STORMWATER AND EQUILIZATION TANKS

TANK

TANK

TANK

TANK

TANK

TANK

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E-Mail Address: potestacadd@newwave.net

Project

BANK STABILIZATION FINAL REPORT
SITE MAP
FLEXSYS AMERICA L.P. PLANT
NITRO, WEST VIRGINIA

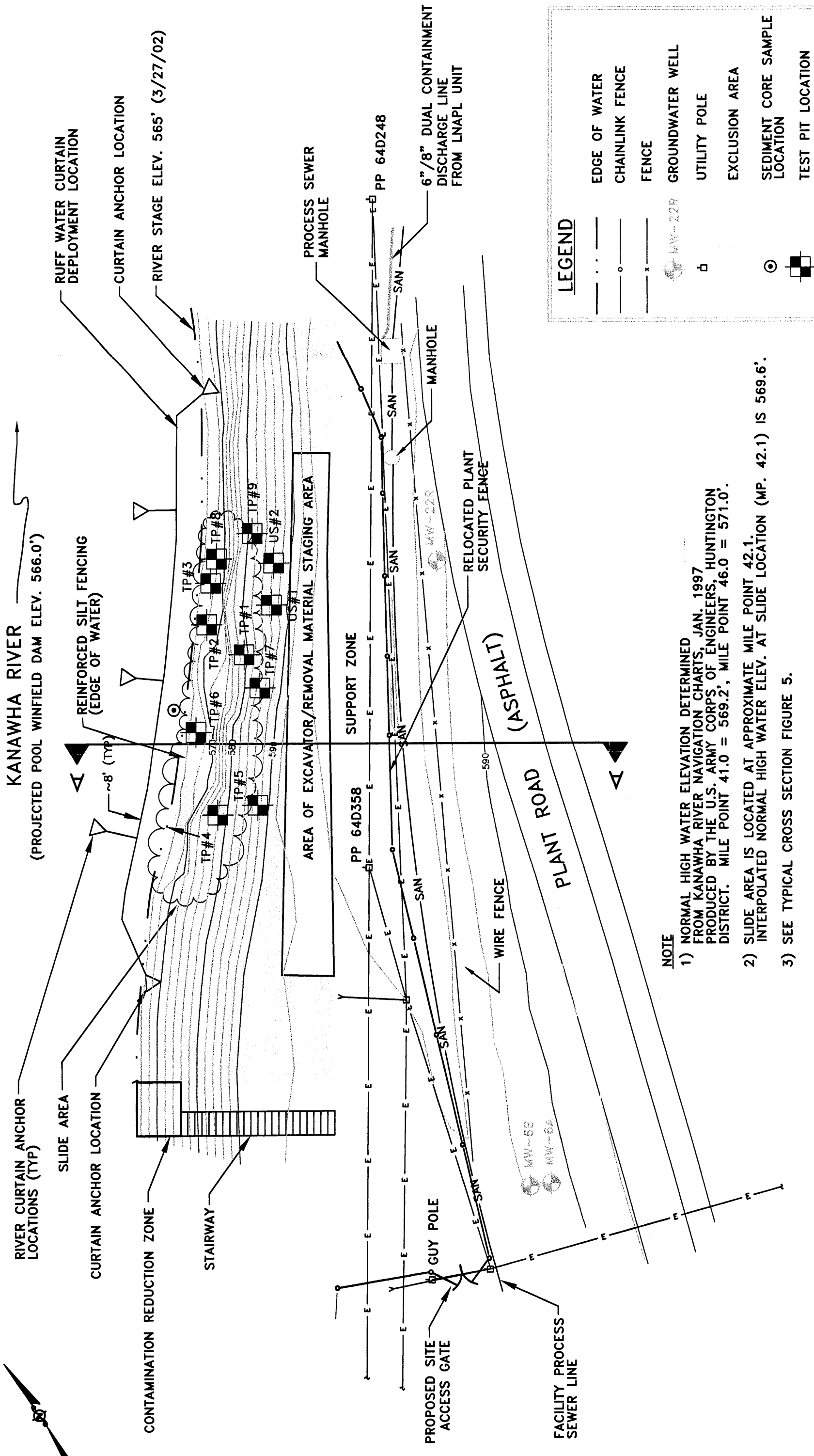
Scale 1"=100'-0"

Dwg. No.

Date MARCH 2003

FIGURE 2

PROJECT #: 01-0081
FILENAME: 801-0081-02



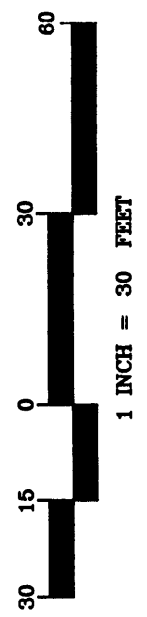
LEGEND

- · — · — EDGE OF WATER
- ○ — CHAINLINK FENCE
- x — FENCE
- ⊙ MW-22R GROUNDWATER WELL
- ⊔ UTILITY POLE
- EXCLUSION AREA
- ⊙ SEDIMENT CORE SAMPLE LOCATION
- ⊕ TEST PIT LOCATION

NOTE

- 1) NORMAL HIGH WATER ELEVATION DETERMINED FROM KANAWHA RIVER NAVIGATION CHARTS, JAN. 1997 PRODUCED BY THE U.S. ARMY CORPS OF ENGINEERS, HUNTINGTON DISTRICT. MILE POINT 41.0 = 569.2', MILE POINT 46.0 = 571.0'.
- 2) SLIDE AREA IS LOCATED AT APPROXIMATE MILE POINT 42.1. INTERPOLATED NORMAL HIGH WATER ELEV. AT SLIDE LOCATION (MP. 42.1) IS 569.6'.
- 3) SEE TYPICAL CROSS SECTION FIGURE 5.

GRAPHIC SCALE



MAPPING REFERENCE:

TOPOGRAPHIC MAPPING PREPARED FROM
GROUND SURVEY INFORMATION COLLECTED BY
POTESTA & ASSOCIATES, INC. ON MARCH 27, 2002.

Potesta & Associates, Inc.

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Project

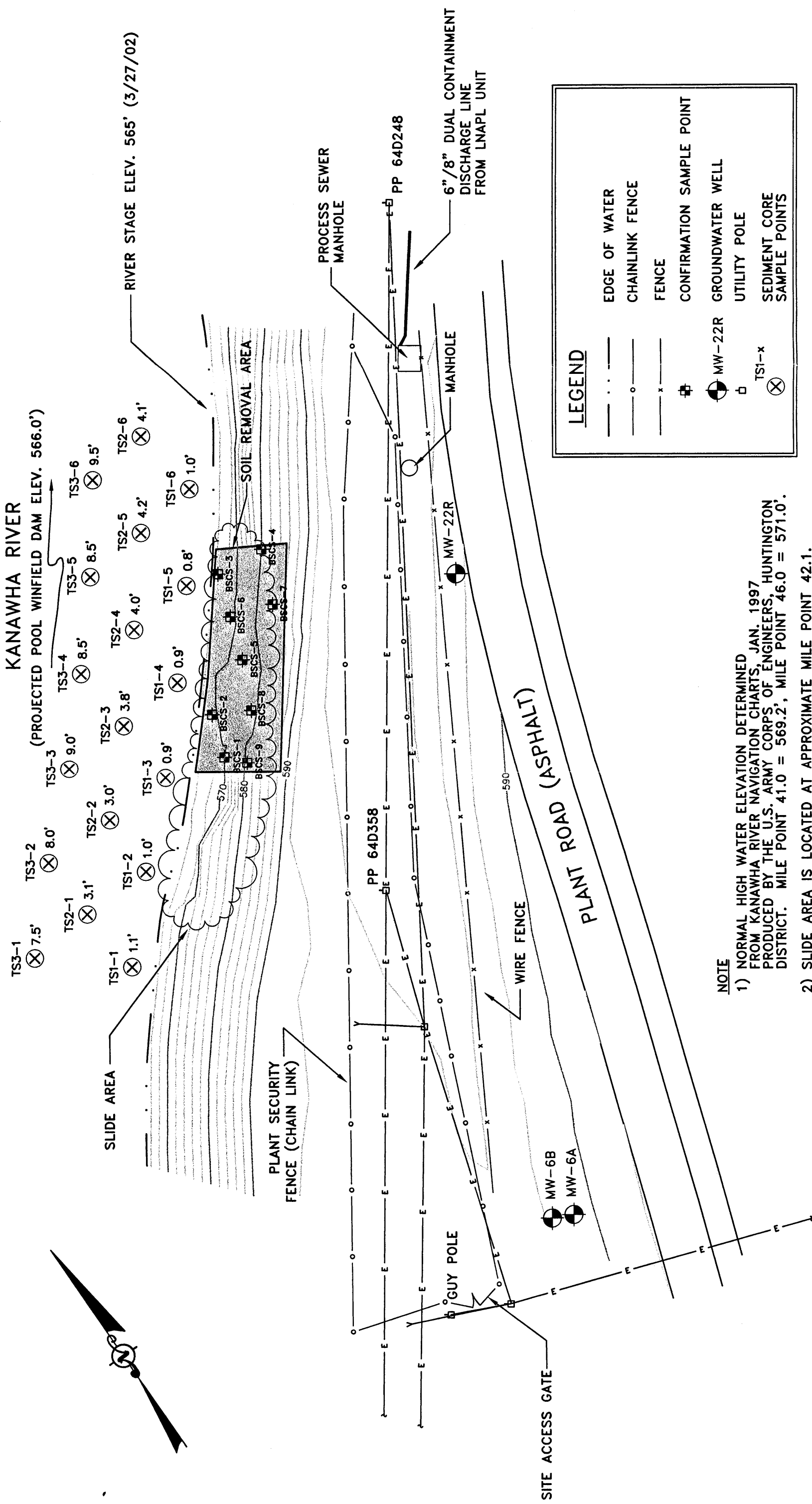
BANK STABILIZATION FINAL REPORT
FLEXSYS AMERICA L.P. PLANT
NITRO, WEST VIRGINIA

Scale 1"=30'

Dwg. No.

Date MARCH 2003

FIGURE 3



LEGEND

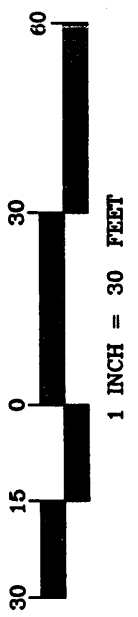
- EDGE OF WATER
- CHAINLINK FENCE
- FENCE
- CONFIRMATION SAMPLE POINT
- GROUNDWATER WELL
- UTILITY POLE
- SEDIMENT CORE SAMPLE POINTS

NOTE

1) NORMAL HIGH WATER ELEVATION DETERMINED FROM KANAWHA RIVER NAVIGATION CHARTS, JAN. 1997 PRODUCED BY THE U.S. ARMY CORPS OF ENGINEERS, HUNTINGTON DISTRICT. MILE POINT 41.0 = 569.2', MILE POINT 46.0 = 571.0'.

2) SLIDE AREA IS LOCATED AT APPROXIMATE MILE POINT 42.1. INTERPOLATED NORMAL HIGH WATER ELEV. AT SLIDE LOCATION (MP. 42.1) IS 569.6'.

GRAPHIC SCALE



MAPPING REFERENCE:

TOPOGRAPHIC MAPPING PREPARED FROM GROUND SURVEY INFORMATION COLLECTED BY POTESTA & ASSOCIATES, INC. ON MARCH 27, 2002.

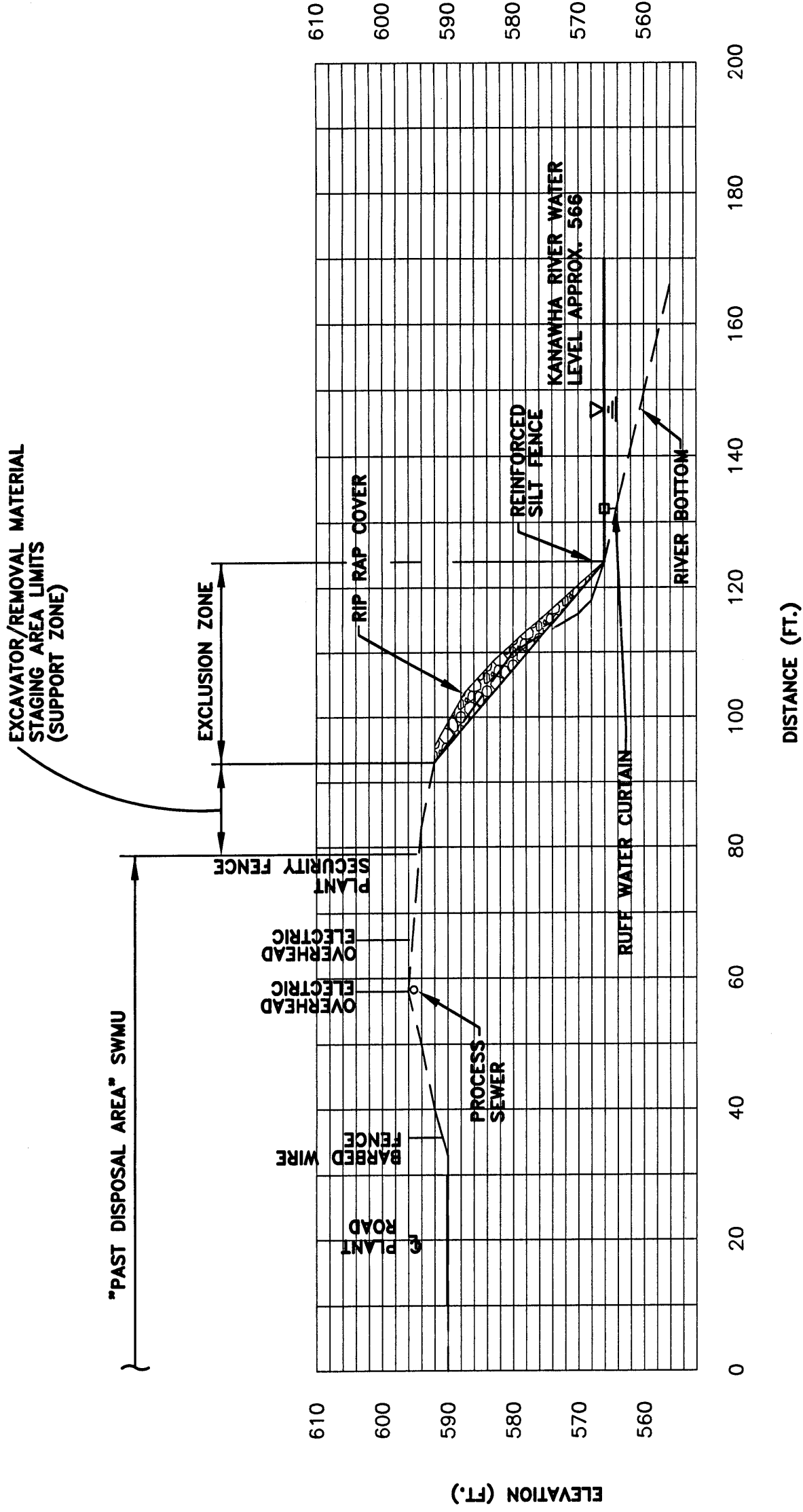
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TYPICAL SITE CROSS SECTION
1"=20'

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Project
BANK STABILIZATION FINAL REPORT
FLEXYS AMERICA L.P. PLANT
NITRO, W.V.
Scale 1"=20'
Date MARCH 2003
Dwg. No.
FIGURE 5

APPENDIX B

TABLE 2
SUBGRADE CONFIRMATION SAMPLING RESULTS

CONFIRMATION SAMPLE TCL VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8260B											
Analytical Parameter	Residential RBC, mg/kg	BSCS-1, mg/kg	BSCS-2, mg/kg	BSCS-3, mg/kg	BSCS-4, mg/kg	BSCS-5, mg/kg	BSCS-6, mg/kg	BSCS-7, mg/kg	BSCS-8, mg/kg	BSCS-9, mg/kg	BSCS-10*, mg/kg
Acetone	7800	0.0249	ND, <0.0234	0.0271	0.0776	ND, <0.0204	0.0452	0.0244	ND, <0.020	ND, <0.020	0.0257
Benzene	12	0.0021	0.0028	ND, <0.00008	0.0168	0.0034	0.0072	0.012	ND, <0.00008	ND, <0.00008	0.0031
Toluene	16000	ND, <0.00008	ND, <0.00008	ND, <0.00008	0.0055	ND, <0.00008	ND, <0.00008	ND, <0.00008	ND, <0.00008	ND, <0.00008	0.0022
Trichloroethene	1.6	0.0029	ND, <0.00005	ND, <0.00005	0.0073	ND, <0.00005	0.0036	ND, <0.00005	ND, <0.00005	ND, <0.00005	0.0036
CONFIRMATION SAMPLE TCL SEMI-VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8270C											
Analytical Parameter	Residential RBC, mg/kg	BSCS-1, mg/kg	BSCS-2, mg/kg	BSCS-3, mg/kg	BSCS-4, mg/kg	BSCS-5, mg/kg	BSCS-6, mg/kg	BSCS-7, mg/kg	BSCS-8, mg/kg	BSCS-9, mg/kg	BSCS-10*, mg/kg
N-Nitrosodiphenylamine	130	65.2	56.5	ND, <00121	ND, <00121	ND, <00121	ND, <00121	2.60	ND, <00121	ND, <00121	14.8

CONFIRMATION SAMPLE ASBESTOS IN ACCORDANCE WITH EPA\600\R-93-116					
Analytical Parameter	Residential RBC, pg/g	BSCS-1, (wt%)	BSCS-2, wt%	BSCS-3, wt%	BSCS-4, wt%
Chrysotile	Not Applicable	ND, 0%	ND, 0%	ND, 0%	ND, 0%
Analytical Parameter	BSCS-5, wt%	BSCS-6, wt%	BSCS-7, wt%	BSCS-8, wt%	BSCS-9, wt%
	ND, 0%	ND, 0%	ND, 0%	ND, 0%	Trace, <1%
Analytical Parameter	BSCS-10*, wt%				
	Trace, <1%				

CONFIRMATION SAMPLE 2,3,7,8 CHLORINATED DIOXIN/FURAN CONGENERS BY EPA METHOD 1613B											
Analytical Parameter	Residential RBC, pg/g	BSCS-1, pg/g	BSCS-2, pg/g	BSCS-3, pg/g	BSCS-4, pg/g	BSCS-5, pg/g	BSCS-6, pg/g	BSCS-7, pg/g	BSCS-8, pg/g	BSCS-9, pg/g	BSCS-10*, pg/g
2,3,7,8-TCDD	4.3	3,940 ^E	373	142	936 ^E	354	869 ^E	863 ^E	1,510 ^E	713 ^E	3,640 ^E
1,2,3,7,8-PeCDD	Not Applicable	506	49.8	12.3	30.8	ND, <41.0	87.7	145	348	66.9	535
1,2,3,4,7,8-HxCDD	Not Applicable	115	12.8	ND, <10.8	7.8	ND, <7.8	ND, <35.0	ND, <34.3	78.0	ND, <12.7	116
1,2,3,6,7,8-HxCDD	Not Applicable	207	ND, <26.5	ND, <11.5	ND, <15.6	ND, <7.6	ND, <42.2	66.5	126	37.5	205
1,2,3,7,8,9-HxCDD	Not Applicable	91.8	ND, <18.3	ND, <11.4	10.5	ND, <7.9	ND, <39.2	ND, <35.4	78.7	16.0	111
1,2,3,4,6,7,8-HpCDD	Not Applicable	729	92.7	22.7	170	48.7	98.5	140	356	229	1,020
1,2,3,4,6,7,8,9-OCDD	Not Applicable	5,850 ^E	709	325	963	505	818	545	2,060	1,520	4,760 ^E
2,3,7,8-TCDF	Not Applicable	219	ND, <21.3	ND, <10.8	37.3	14.6	38.1	66.7	132	82.1	277
1,2,3,7,8-PeCDF	Not Applicable	ND, <93.2	ND, <8.0	ND, <5.9	11.6 ^X	ND, <5.1	11.6 ^X	ND, <14.9	36.9	31.8 ^X	ND, <94.0
2,3,4,7,8-PeCDF	Not Applicable	104	ND, <8.0	ND, <5.0	5.2	ND, <3.5	ND, <14.3	12.4	15.4	62.8	111
1,2,3,4,7,8-HxCDF	Not Applicable	188	ND, <12.5	ND, <7.9	10.9	ND, <5.3	ND, <21.6	ND, <20.9	26.7	60.1	278
1,2,3,6,7,8-HxCDF	Not Applicable	57.5	ND, <13.0	ND, <9.2	ND, <4.9	ND, <5.2	ND, <22.0	ND, <20.4	ND, <6.6	17.1	86.6
2,3,4,6,7,8-HxCDF	Not Applicable	ND, <14.8	ND, <17.4	ND, <8.6	ND, <7.8	ND, <6.2	ND, <52.5	ND, <56.1	ND, <13.1	29.9	136
1,2,3,4,6,7,8-HpCDF	Not Applicable	340	32.4	ND, <22.7	34.7	ND, <26.0	ND, <42.8	ND, <38.7	77.5	86.3	500
1,2,3,4,7,8,9-HpCDF	Not Applicable	79.4	ND, <38.0	ND, <20.4	ND, <18.1	ND, <12.8	ND, <64.1	ND, <68.4	ND, <23.3	13.9	88.9
1,2,3,4,6,7,8,9-OCDF	Not Applicable	973	78.6	24.0	39.3	107	60.7	65.3	160	114	705

^E

Indicates a concentration based on an analyte to internal standard ratio which exceeds the range of the calibration curve. Values which are outside the calibration curve are estimates only.

^X

Indicates that a polychlorodibenzofuran (PCDF) peak has eluted at the same time as the associated diphenyl ether (DPE) and that the DPE peak intensity is at least ten percent of the total PCDF peak intensity. Total PCDF values are flagged 'X' if the total DPE contribution to the total PCDF value is greater than ten percent. All PCDF peaks that are significantly influenced by the presence of DPE peaks are either reported as estimated maximum possible concentration (EMPC) values without regard to the isotopic abundance ratio, or are included in the detection limit value depending on the analytical method.

*

Sample BSCS-10 is a field duplicate of sample BSCS-1.

TABLE 3
ROLLOFF ANALYTICAL RESULTS
(Continued)

ROLLOFF 2,3,7,8 CHLORINATED DIOXIN/FURAN CONGENERS BY EPA METHOD 1613B										
1,2,3,6,7,8-HxCDF	Not Applicable	116	ND, <4.6	ND, <2.4	ND, <41.0	ND, <9.2	ND, <12.2	ND, <21.4	ND, <10.5	92.8
2,3,4,6,7,8-HxCDF	Not Applicable	47.7	ND, <5.5	ND, <3.5	ND, <61.4	ND, <18.0	ND, <16.9	ND, <35.6	ND, <12.7	ND, <44.0
1,2,3,7,8,9-HxCDF	Not Applicable	26.0	ND, <7.1	ND, <3.5	ND, <59.4	ND, <15.7	ND, <21.8	ND, <32.5	ND, <17.3	ND, <51.1
1,2,3,4,6,7,8-HpCDF	Not Applicable	499	18.3	ND, <22.9	ND, <69.7	110	87.9	ND, <121	ND, <28.4	420
1,2,3,4,7,8,9-HpCDF	Not Applicable	188	ND, <12.1	ND, <6.8	ND, <91.7	ND, <25.4	ND, <36.1	ND, <55.3	ND, <32.7	ND, <182
1,2,3,4,6,7,8,9-OCDF	Not Applicable	2,670	36.3	68.4	ND, <189	1,110	185	365	38.6	655

E Indicates a concentration based on an analyte to internal standard ratio which exceeds the range of the calibration curve. Values which are outside the calibration curve are estimates only.
x Indicates that a polychlorodibenzofuran (PCDF) peak has eluted at the same time as the associated diphenyl ether (DPE) and that the DPE peak intensity is at least ten percent of the total PCDF peak intensity. Total PCDF values are flagged 'X' if the total DPE contribution to the total PCDF value is greater than ten percent. All PCDF peaks that are significantly influenced by the presence of DPE peaks are either reported as estimated maximum possible concentration (EMPC) values without regard to the isotopic abundance ratio, or are included in the detection limit value depending on the analytical method.

TABLE 3
ROLLOFF ANALYTICAL RESULTS
(Continued)

ROLLOFF TCL VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8260B										
Analytical Parameter	Residential RBC, mg/kg	S-10, milligrams per kilogram (mg/kg)	S-11, mg/kg	S-12, mg/kg	S-13, mg/kg	S-14, mg/kg	S-15*, mg/kg	MS/MSD, mg/kg	EDR-1, mg/kg	Trip Blanks, mg/kg
Acetone	7800	0.0159	ND, <0.0112	ND, <0.0111	ND, <0.0112	0.0130	ND, <0.0107	0.0147	ND, <0.0100	ND, <0.0100
Benzene	12	0.0027	0.0173	ND, <0.0022	0.0052	0.0103	0.0129	0.0024	ND, <0.0010	ND, <0.0010
Carbon Disulfide	7800	0.0123	ND, <0.0112	0.0305	ND, <0.0112	ND, <0.0108	0.0115	ND, <0.0104	ND, <0.0100	ND, <0.0100
1,2-Dibromo-3-chloropropane	0.46	ND, <0.0025	ND, <0.0022	ND, <0.0022	ND, <0.0022	ND, <0.0022	ND, <0.0021	ND, <0.0021	ND, <0.0010	ND, <0.0010
Toluene	16000	ND, <0.0025	0.0042	ND, <0.0022	ND, <0.0022	ND, <0.0022	0.0024	ND, <0.0021	ND, <0.0010	ND, <0.0010
Trichloroethene	1.6	0.0043	0.0102	ND, <0.0022	0.0026	0.0056	0.0093	ND, <0.0021	ND, <0.0010	ND, <0.0010
ROLLOFF TCL SEMI-VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8270C										
Analytical Parameter	Residential RBC, mg/kg	S-10, milligrams per kilogram (mg/kg)	S-11, mg/kg	S-12, mg/kg	S-13, mg/kg	S-14, mg/kg	S-15*, mg/kg	MS/MSD, mg/kg	EDR-1, mg/kg	Trip Blanks, mg/kg
N-Nitrosodiphenylamine	130	ND, <99.9	ND, <9.99	29.2	ND, <9.99	ND, <9.99	ND, <9.99	ND, <9.99	ND, <0.0086	Not Applicable

ROLLOFF ASBESTOS IN ACCORDANCE WITH EPA\600\R-93-116					
Analytical Parameter	Residential RBC, pg/g	S-10, weight % asbestos (wt%)	S-11, wt%	S-12, wt%	S-13, wt%
Amosite (A), Chrysotile (Ch), Crocidolite (Cr)	Not Applicable	Ch Trace, <1%	A and Ch Trace, <1%	Ch Trace, <1%	Ch and Cr Trace, <1%
					S-14, wt%
					S-15*, wt%
					A and Ch Trace, <1%

ROLLOFF 2,3,7,8 CHLORINATED DIOXIN/FURAN CONGENERS BY EPA METHOD 1613B							
Analytical Parameter	Residential RBC, pg/g	S-10, picograms per gram (pg/g)	S-11, pg/g	S-12, pg/g	S-13, pg/g	S-14, pg/g	S-15*, pg/g
2,3,7,8-TCDD	4.3	1,150 ^E	221	982 ^E	344	507 ^E	530 ^E
1,2,3,7,8-PeCDD	Not Applicable	287	42.6	105	75.3	79.0	85.9
1,2,3,4,7,8-HxCDD	Not Applicable	51.0	10.0	22.2	ND, <11.6	ND, <18.0	ND, <18.7
1,2,3,6,7,8-HxCDD	Not Applicable	68.8	21.6	43.9	24.2	39.5	36.6
1,2,3,7,8,9-HxCDD	Not Applicable	46.7	ND, <16.1	30.9	ND, <13.8	ND, <18.9	25.2
1,2,3,4,6,7,8-HpCDD	Not Applicable	191	169	645	109	ND, <170	181
1,2,3,4,6,7,8,9-OCDD	Not Applicable	86.6	ND, <23.1	6,810 ^E	662	1,410	1,610
2,3,7,8-TCDF	Not Applicable	ND, <5.3	15.9	44.5	24.2	42.1	32.7
1,2,3,7,8-PeCDF	Not Applicable	43.4	10.4	10.2	8.4 ^X	7.8	11.4
2,3,4,7,8-PeCDF	Not Applicable	93.5	ND, <2.9	13.3	ND, <5.7	7.3	7.0
1,2,3,4,7,8-HxCDF	Not Applicable	36.8	14.3	137	ND, <7.8	ND, <30.7	23.1
1,2,3,6,7,8-HxCDF	Not Applicable	36.0	ND, <3.9	26.1	ND, <8.3	ND, <11.6	ND, <6.2
2,3,4,6,7,8-HxCDF	Not Applicable	ND, <11.6	ND, <4.7	18.5	ND, <9.1	ND, <13.8	ND, <7.4
1,2,3,7,8,9-HxCDF	Not Applicable	180	ND, <6.1	ND, <1.6	ND, <12.9	ND, <18.4	ND, <9.0
1,2,3,4,6,7,8-HpCDF	Not Applicable	49.2	29.4	216	29.9	70.3	66.1
1,2,3,4,7,8,9-HpCDF	Not Applicable	ND, <10.3	ND, <11.3	50.5	ND, <25.1	ND, <30.5	ND, <14.0
1,2,3,4,6,7,8,9-OCDF	Not Applicable	149	68.9	947	61.7	172	181

E Indicates a concentration based on an analyte to internal standard ratio which exceeds the range of the calibration curve. Values which are outside the calibration curve are estimates only.

X Indicates that a polychlorodibenzofuran (PCDF) peak has eluted at the same time as the associated diphenyl ether (DPE) and that the DPE peak intensity is at least ten percent of the total PCDF peak intensity. Total PCDF values are flagged 'X' if the total DPE contribution to the total PCDF value is greater than ten percent. All PCDF peaks that are significantly influenced by the presence of DPE peaks are either reported as estimated maximum possible concentration (EMPC) values without regard to the isotopic abundance ratio, or are included in the detection limit value depending on the analytical method.

* Sample S-15 is a field duplicate of sample S-14.

APPENDIX C



Photo 1: Perimeter Fence Relocation

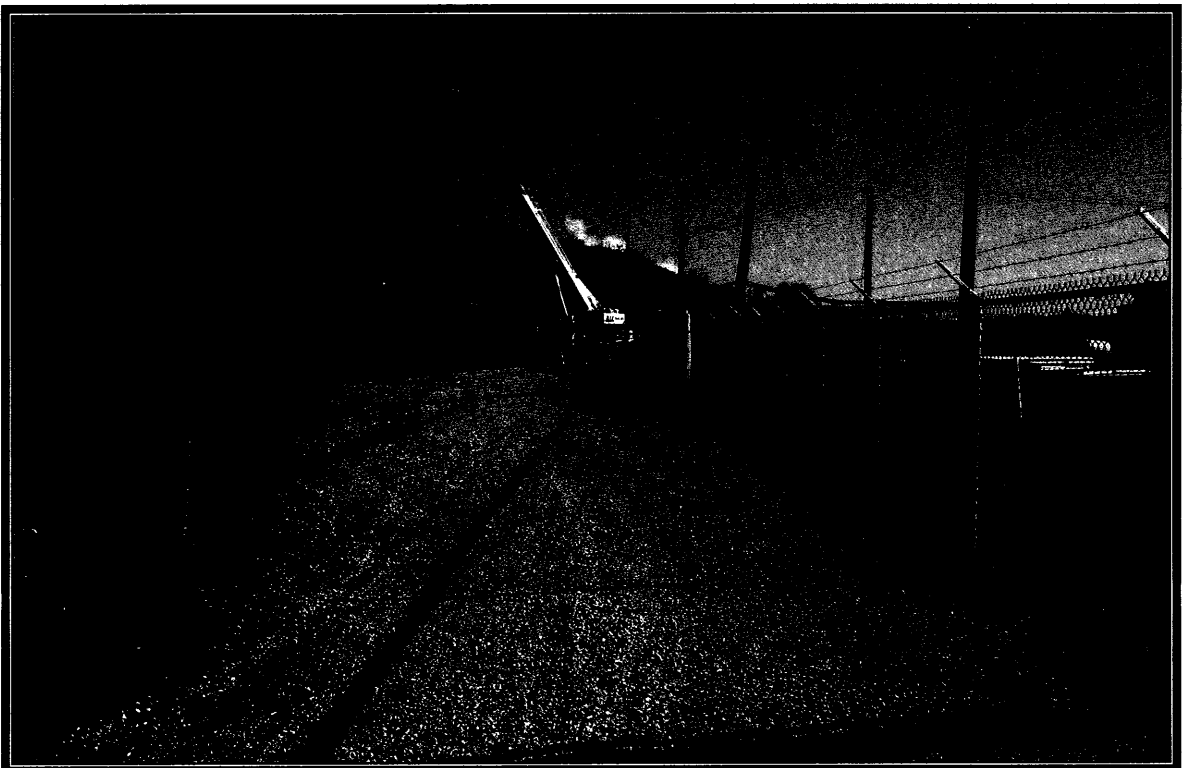


Photo 2: Site Access Road and New Perimeter Fence

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Solutia, Inc.

675 Maryville Centre Drive
St. Louis, Missouri 63141
Project No. 01-0081-140



Photo 3: Stabilization Activities



Photo 4: Slope Excavation Procedure

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Photo 5: Ruff Water Curtain

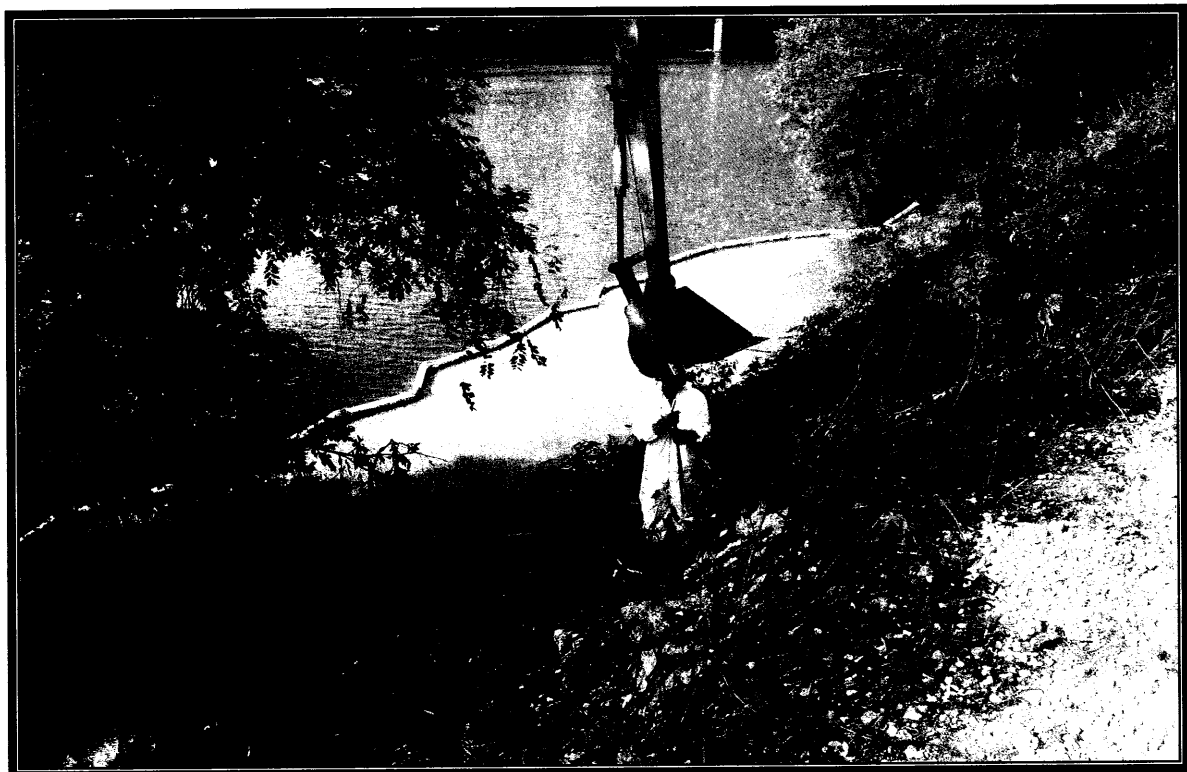


Photo 6: Test Pit Location

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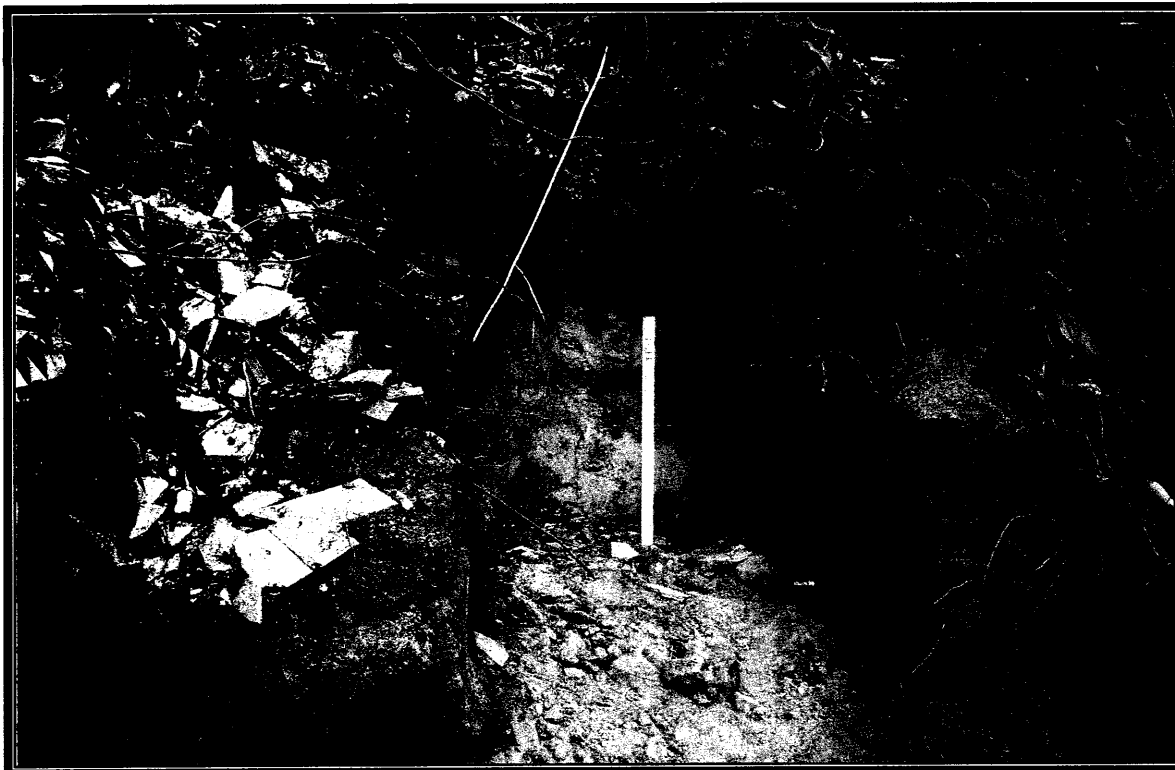


Photo 7: Typical Test Pit



Photo 8: Test Pit Sampling

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Photo 9: Slope Excavation Procedure

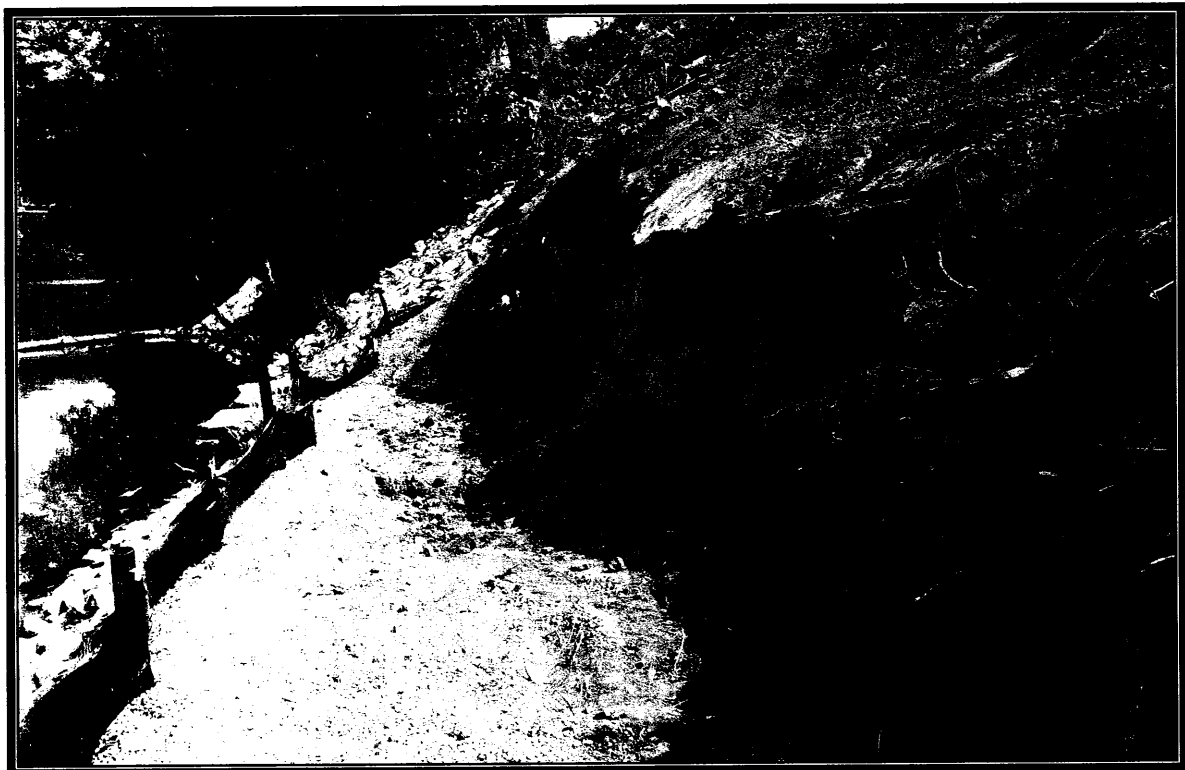


Photo 10: Toe of Embankment After Removal of Sloughed Material

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Photo 11: Excavated Bank

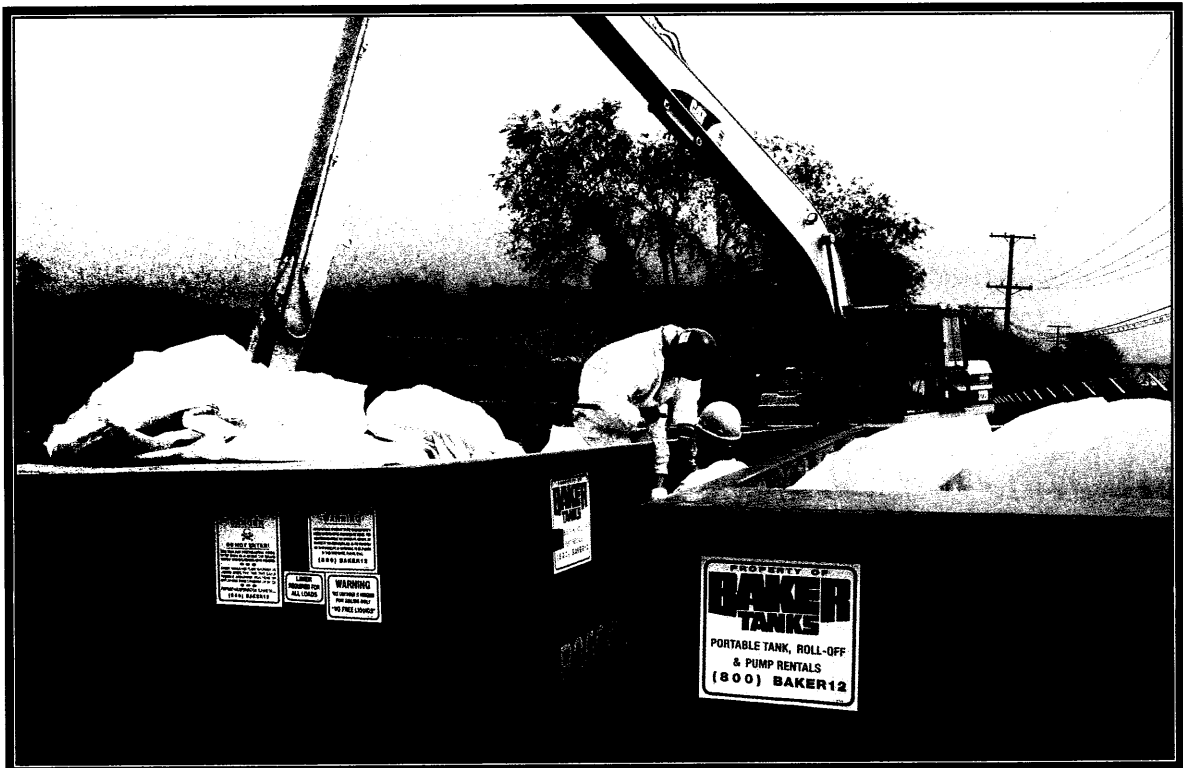


Photo 12: Loading Roll Offs

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 Project No. 01-0081-140



Photo 13: Embankment Area After Removal of Topsoil and Construction Debris



Photo 14: Toe Area and Silt Fence

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Photo 15: Placement of Geotextile Membrane



Photo 16: Geotextile Membrane and Rip Rap Placement

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Photo 17: Upstream Anchor for Ruff Water Curtain

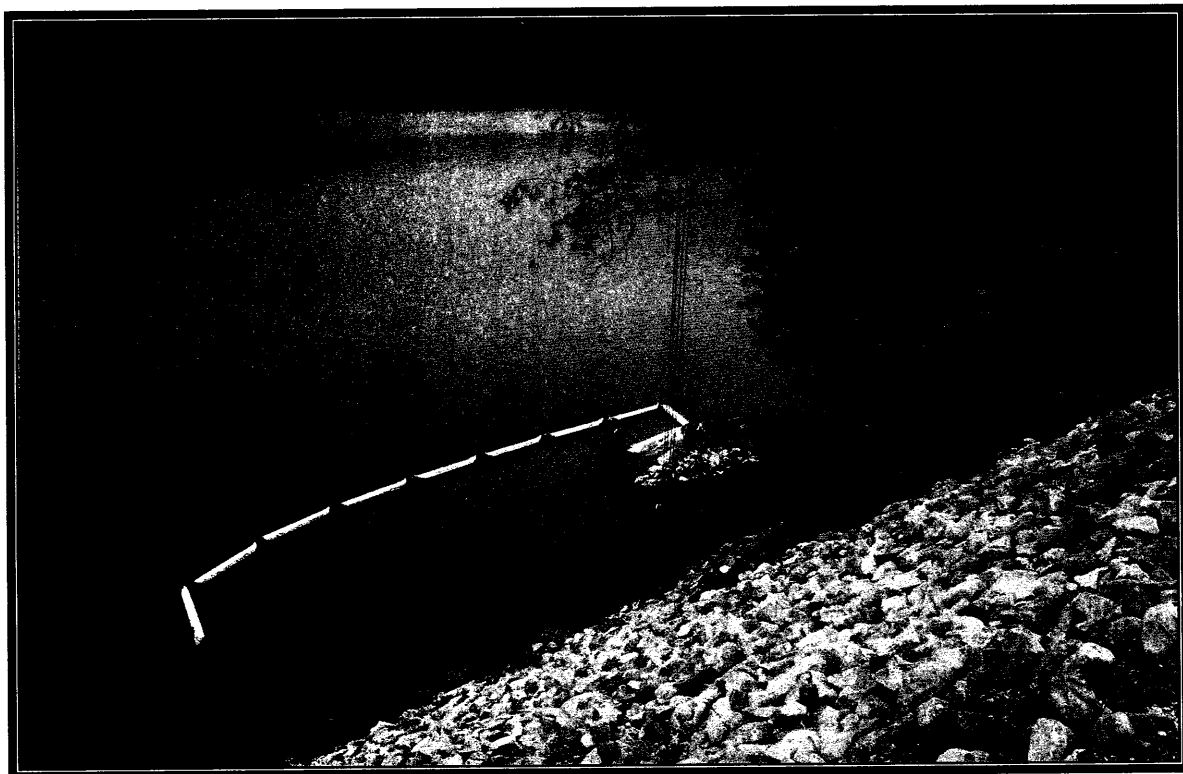


Photo 18: Removal of Ruff Water Curtain

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Photo 19: Test Pit 1



Photo 20: Test Pit 2

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Project No. 01-0081-140



Photo 21: Test Pit 3



Photo 22: Test Pit 4

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Photo 23: Test Pit 5



Photo 24: Test Pit 6

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Photo 25: Test Pit 7



Photo 26: Test Pit 8

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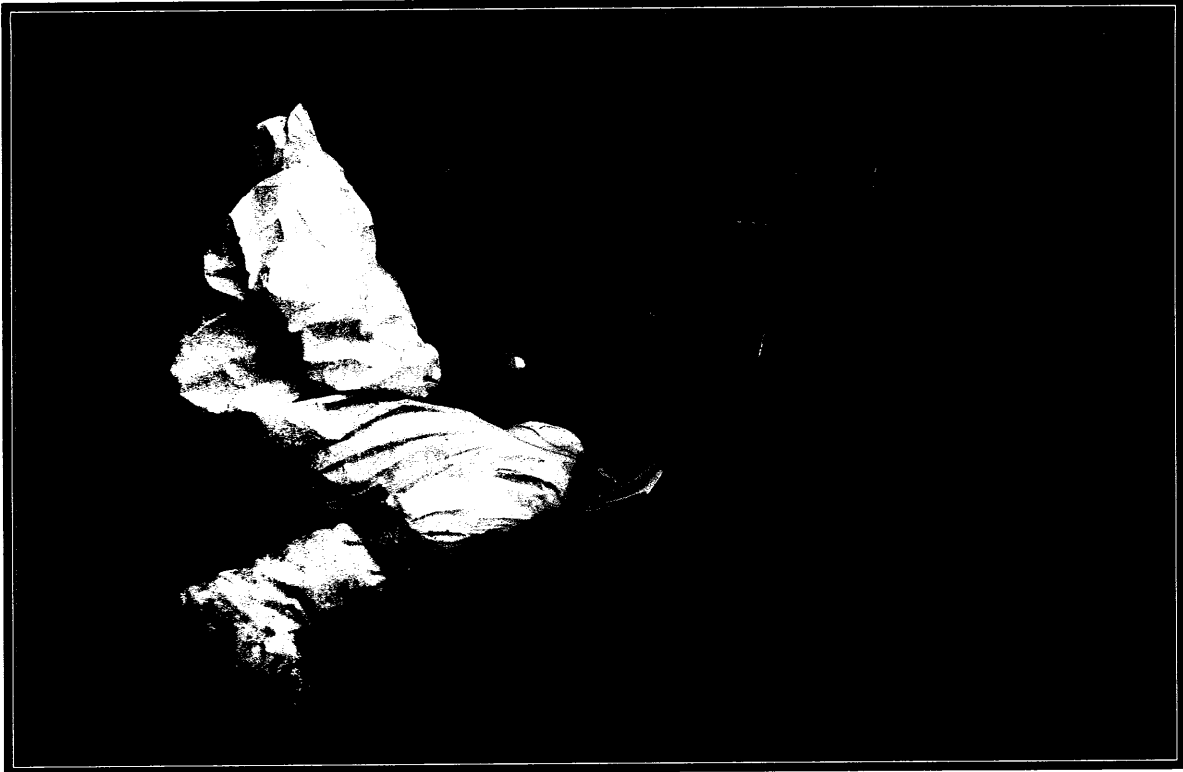


Photo 27: Test Pit 9

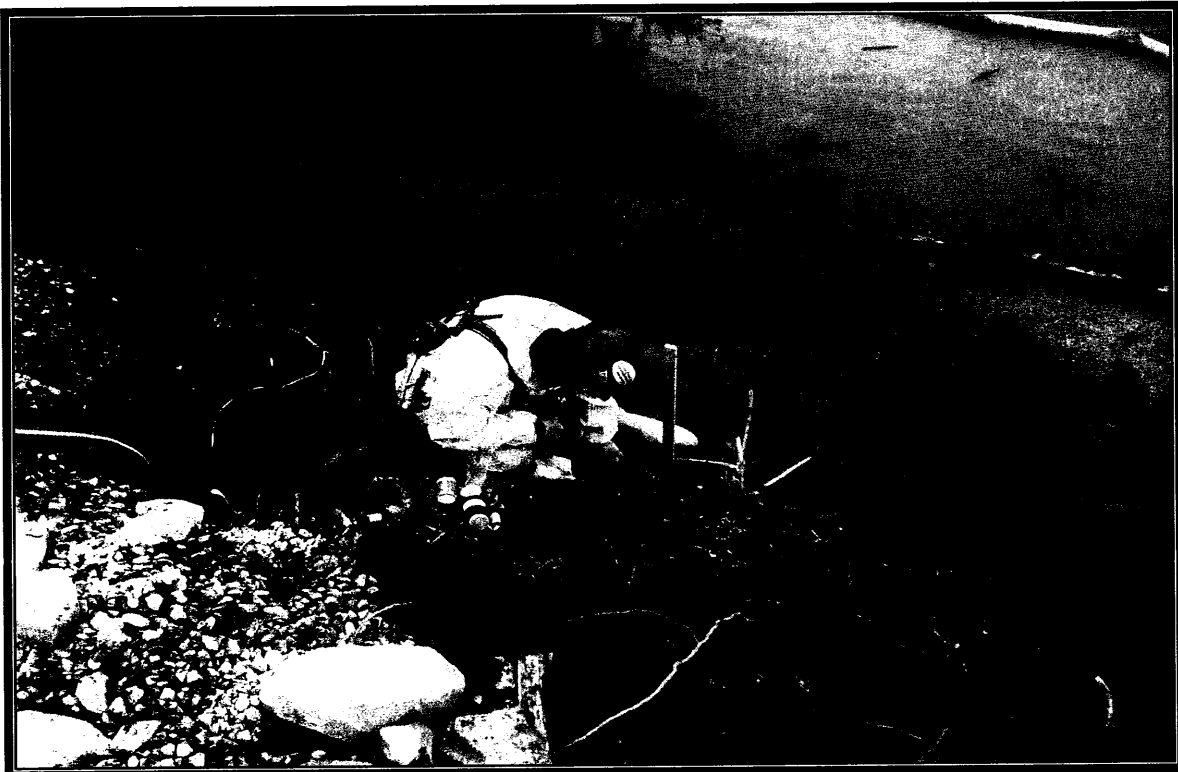


Photo 28: Confirmation Sampling Procedure

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APPENDIX D

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1.0 Introduction

Air sampling and monitoring was conducted during the site activities to:

- Collect background concentration data of aniline, n-nitro, dusts and total volatile organic compounds (VOCs) in the air prior to site remediation activities. The background data is useful to compare to air concentrations during the performance of specific tasks.
- Determine airborne concentrations to workers during test pit and excavation work. These work activities will be comparable from a potential exposure perspective to excavation activities.
- Collect air monitoring data for the determination of personal protective equipment during excavation activities.
- Collect airborne concentration data to evaluate the effectiveness of engineering controls and work practices.
- Collect information to develop a correlation between real time monitoring instrumentation and exposure sampling data.
- Serve as a preliminary warning to potential elevating emissions at the fenceline monitoring stations.
- Determine the need for application of dust controls.
- Confirm the effectiveness of engineering controls in protecting the surrounding public and environment.

2.0 Baseline Air Survey

Prior to any intrusive construction activities, a baseline air survey was conducted on August 28 and August 29 to measure background airborne concentrations of VOCs and particulates, as well as collect air samples to determine the airborne concentrations of aniline and n-nitrosodiphenylamine. The following monitoring and sampling was conducted:

2.1 Real-time Air Monitoring

2.1.1 VOLATILE ORGANIC COMPOUNDS

The PhotoVac 2020 from Perkin Elmer was utilized to detect volatile organic compounds in the air. The PhotoVac system incorporates a photoionization detector with a standard 10.6 eV lamp to detect total volatile organic compounds in the sampled air. Sampling air is pumped into the detector lamp through an internal pump at a rate of 150 cubic centimeter (cc) per minute. The limit of detection on the PhotoVac system is 0.1 ppm on the 0 to 200 ppm range and 1 ppm on the 200 to 2000 range. For the purposes of this application, the 0.1 ppm LOD was utilized. Additional manufacturer specifications for the PhotoVac are contained in Attachment 1 of this report.

2.1.2 AIRBORNE PARTICULATE MONITORING

Airborne dusts were monitored utilizing the DataRam 2000 and personal DataRam real time aerosol monitors from Measurement Instruments for the Environment (MIE). The DataRAM 2000 was equipped with an omnidirectional sampling inlet and integrated sample collection port to measure mass concentrations of airborne particles. The DataRam incorporates continuous real time monitoring utilizing a built in diaphragm pump with constant, regulated flow set for 2.0 liter per minute (lpm). The measurement

range for the DataRam is 0.0001 mg/m³ (0.1 ug/m³) to 400 mg/m³. Manufacturer specifications for the DataRam are contained in Attachment 1 of this report.

2.2 Air Sampling and Analysis

2.2.1 ANILINE (BY NIOSH 2002)

Aniline samples were collected and analyzed following NIOSH Method 2002, located in Attachment 2. The Lower Limit of Quantification following this method is approximately 10 micrograms. The sampling method involves the collection of a sample by drawing air through a silica gel tube connected to a low flow air sampling pump. The samples were placed in a refrigerator or cooler after sampling, and shipped overnight to Spectrum Analytical Laboratories located in Agawam, Massachusetts.

2.2.2 N-NITROSODIPHENYLAMINE (BY NIOSH 2522)

N-Nitrosodiphenylamine samples were collected following NIOSH Method 2522, as located in Attachment 2. The Lower Limit of Quantification following this method is approximately 0.030 micrograms. Thermosorb-N Cartridges connected to low flow air sampling pumps. The samples were placed in a refrigerator after sampling and a cooler during shipping and shipped overnight to Spectrum Analytical Laboratories located in Agawam, Massachusetts.

2.3 Air Sampling and Monitoring Locations

Specific locations of air monitoring and sampling were determined in the field prior to the sampling and monitoring event by the Health and Safety Officer and the Construction Manager. One upwind, one downwind and one work area sampling location were targeted for monitoring and sample collection during the background event. Specific locations were based upon:

- Anticipated nearby operations during sampling/monitoring period
- Anticipated future operations during sampling/monitoring period
- Accessibility to locations by field personnel
- Historic and current weather conditions
- Location in reference to sensitive receptors

Taking into account the topography and the physical site characteristics at the site, a north, south and east station were selected for use as monitoring stations. The site is immediately bound by the Kanawha River to the west and therefore a west station was not practical. As a precaution for field personnel, no monitoring stations were located at the bottom of the slope not accessible by the staircase. These stations were utilized for the duration of the project and are depicted on the figure located in Attachment 3.

Outlined below in Table 1.0 is a summary of the sampling and monitoring conducted during the Baseline Air Survey conducted on August 28 and August 29. Results of the sampling and analysis conducted is located in Section 5.0 of this report.

Table 1.0 Summary of Sampling and Monitoring Baseline Survey				
Date	Sample ID	Station	Analysis	Type
28-Aug-02	A-020828-N	North	NN	Sampling
	A-020828-S	South	NN	Sampling
	A-020828-E	East	NN	Sampling
	A-020828-N	North	Aniline	Sampling
	A-020828-S	South	Aniline	Sampling
	A-020828-E	East	Aniline	Sampling
	-	South	Dusts	Real Time
	-	North	Dusts	Real Time
	-	East	Dusts	Real Time
	-	Work Area	Dusts	Real Time
	-	South	VOCs	Real Time
	-	Work Area	VOCs	Real Time
	-	East	VOCs	Real Time
	-	North	VOCs	Real Time
29-Aug-02	A-020829-N-BL	North	Aniline	Sampling
	A-020829-S-BL	South	Aniline	Sampling
	A-020829-E-BL	East	Aniline	Sampling
	A-020829-WA-BL	Work Area	Aniline	Sampling

Note:
NN – N-Nitrosodiphenylamine

3.0 Perimeter/Work Air Monitoring and Sampling

During intrusive work, air monitoring and sampling was conducted within the work Area, as well as at the perimeter of the site. Test pitting activities were conducted on August 29, 2002 and soil excavation was conducted on September 16 and 17, 2002. During these activities, air monitoring and sampling was conducted to measure airborne concentrations of particulates, volatile organic compounds, as well as collect air samples for laboratory analysis of aniline and n-nitrosodiphenylamine. The following sampling and monitoring was conducted:

3.1 Real-time Air Monitoring

3.1.1 VOLATILE ORGANIC COMPOUNDS

The PhotoVac 2020 from Perkin Elmer was utilized to detect volatile organic compounds in the air. The PhotoVac system incorporates a photoionization detector with a standard 10.6 eV lamp to detect total volatile organic compounds in the sampled air. Sampling air is pumped into the detector lamp through an internal pump at a rate of 150 cubic centimeter (cc) per minute. The limit of detection on the PhotoVac system is 0.1 ppm on the 0 to 200 ppm range and 1 ppm on the 200 to 2000 range. For the purposes of this application, the 0.1 ppm LOD was utilized. Additional manufacturer specifications for the PhotoVac are contained in Attachment 1 of this report.

3.1.2 AIRBORNE PARTICULATE MONITORING

Airborne dusts were monitored utilizing the DataRam 2000 and personal DataRam real time aerosol monitors from Measurement Instruments for the Environment (MIE). The DataRAM 2000 was equipped with an omnidirectional sampling inlet and integrated sample collection port to measure mass concentrations of airborne particles. The DataRam incorporates continuous real time monitoring utilizing a built in diaphragm pump with constant, regulated flow set for 2.0 liter per minute (lpm). The measurement range for the DataRam is 0.0001 mg/m^3 (0.1 ug/m^3) to 400 mg/m^3 . Manufacturer specifications for the DataRam are contained in Attachment 1 of this report.

3.2 Air Sampling and Analysis

3.2.1 ANILINE (BY NIOSH 2002)

Aniline samples were collected and analyzed following NIOSH Method 2002, located in Attachment 2. The Lower Limit of Quantification following this method is approximately 10 micrograms. The sampling method involves the collection of a sample by drawing air through a silica gel tube connected to a low flow air sampling pump. The samples were placed in a refrigerator or cooler after sampling, and shipped overnight to Spectrum Analytical Laboratories located in Agawam, Massachusetts.

3.2.2 N-NITROSODIPHENYLAMINE (BY NIOSH 2522)

N-Nitrosodiphenylamine samples were collected following NIOSH Method 2522, as located in Attachment 2. The Lower Limit of Quantification following this method is approximately 0.030 micrograms. Thermosorb-N Cartridges connected to low flow air sampling pumps. The samples were placed in a refrigerator after sampling and a cooler during shipping and shipped overnight to Spectrum Analytical Laboratories located in Agawam, Massachusetts.

3.3 Air Sampling and Monitoring Locations

Specific locations of air monitoring and sampling were determined in the field prior to the sampling and monitoring event by the Health and Safety Officer and the Construction Manager. One upwind, one downwind and one work area sampling location were targeted for monitoring and sample collection during the background event. In some cases, additional locations were monitored to collect additional data. Specific locations were based upon:

- Anticipated nearby operations during sampling/monitoring period
- Anticipated future operations during sampling/monitoring period
- Accessibility to locations by field personnel
- Historic and current weather conditions
- Location in reference to sensitive receptors

Taking into account the topography and the physical site characteristics at the site, a north, south and east station were selected for use as monitoring stations. The site is

immediately bound by the Kanawha River to the west and therefore a west station was not practical. Depending upon the daily activities, the east station was located in close proximity to the rolloff staging area and served as a Work Area station.

As a safety precaution for field personnel, no monitoring stations were located at the bottom of the slope not accessible by the staircase. These stations were utilized for the duration of the project and are depicted on the figure located in Attachment 3.

As a result of high temperature and humidity, workers were entering and exiting the exclusion zone routinely. Due to field conditions, it was determined in the field that personal air sampling data was to be conducted as a continuous stationary sample within the exclusion zone rather than directly attached to workers. By collecting these samples closest to the areas of contamination and areas where the most disturbance of the contaminated soil would occur, the intention was to collect a more aggressive sample. This determination was made as a result of harsh working conditions related to topography, personal protective equipment and temperatures. Field workers were in working Level B personal protective equipment while supporting the project at the excavation on the slope. Workers were handling digital photography equipment, two radios for communication with heavy equipment operator, as well as hand tools for digging. As a result, the air samples collected were representative of a whole shift in the exclusion zone, rather than partial shifts, which were required due to concerns for worker fatigue and heat injury.

Outlined below in Table 2.0 is a summary of the sampling and monitoring conducted during the intrusive activities conducted on August 29, September 16 and September 17. Results of the sampling and analysis conducted are discussed in Section 5.0 of this report.

Table 2.0 Summary of Sampling and Monitoring Intrusive Work					
Date	Sample ID	Station	Analysis	Type	Activity
29-Aug-02	A-020829-N	North	NN	Sampling	Testpitting
	A-020829-S	South	NN	Sampling	Testpitting
	A-020829-E	East	NN	Sampling	Testpitting
	A-020829-WA	Work Area	NN	Sampling	Testpitting
	A-020829-N	North	Aniline	Sampling	Testpitting
	A-020829-S	South	Aniline	Sampling	Testpitting
	A-020829-E	East	Aniline	Sampling	Testpitting
	A-020829-WAI	Work Area	Aniline	Sampling	Testpitting
	A-020829-WAI	Work Area	Aniline	Sampling	Testpitting
	8/29/2002	RO Area / East	Dusts	Real Time	Testpitting
	8/29/2002	South	Dusts	Real Time	Testpitting
	8/29/2002	North	Dusts	Real Time	Testpitting
	8/29/2002	East	Dusts	Real Time	Testpitting
	8/29/2002	Work Area	Dusts	Real Time	Testpitting
	8/29/2002	East	VOCs	Real Time	Testpitting
	8/29/2002	North	VOCs	Real Time	Testpitting
	8/29/2002	Work Area	VOCs	Real Time	Testpitting
	8/29/2002	South	VOCs	Real Time	Testpitting

Table 2.0
Summary of Sampling and Monitoring
Intrusive Work

Date	Sample ID	Station	Analysis	Type	Activity
16-Sep-02	A-020916-N	North	NN	Sampling	Excavation
	A-020916-S	South	NN	Sampling	Excavation
		East / Work			
	A-020916-E/WA	Area	NN	Sampling	Excavation
	A-020916-N	North	Aniline	Sampling	Excavation
	A-020916-S	South	Aniline	Sampling	Excavation
		East / Work			
	A-020916-E/WA	Area	Aniline	Sampling	Excavation
	9/16/2002	North	Dust	Real Time	Excavation
	9/16/2002	South	Dust	Real Time	Excavation
	9/16/2002	East	Dust	Real Time	Excavation
	9/16/2002	WZ	Dust	Real Time	Excavation
	9/16/2002	East	VOCs	Real Time	Excavation
	9/16/2002	Work Area	VOCs	Real Time	Excavation
17-Sep-02		South	VOCs	Real Time	Excavation
		North	VOCs	Real Time	Excavation
	A-020917-N	North	NN	Sampling	Excavation
	A-020917-S	South	NN	Sampling	Excavation
	A-020917-E	East	NN	Sampling	Excavation
	A-020917-WA	Work Area	NN	Sampling	Excavation
	A-020917-N	North	Aniline	Sampling	Excavation
	A-020917-S	South	Aniline	Sampling	Excavation
	A-020917-E	East	Aniline	Sampling	Excavation
	A-020917-WA	Work Area	Aniline	Sampling	Excavation
	9/17/2002	East	VOC	Real Time	Excavation
	9/17/2002	Work Area	VOC	Real Time	Excavation
	9/17/2002	South	VOC	Real Time	Excavation
	9/17/2002	North	VOC	Real Time	Excavation
	9/17/2002	Work Area	Dust	Real Time	Excavation
	9/17/2002	South	Dust	Real Time	Excavation
	9/17/2002	East	Dust	Real Time	Excavation
	9/17/2002	North	Dust	Real Time	Excavation
	9/17/2002	Work Area	Dust	Real Time	Excavation

Note:
NN – N-Nitrosodiphenylamine

4.0 Meteorological Monitoring

In an effort to understand air movement at the Site, a meteorological station was setup and configured to collect data during air monitoring and sampling events. The data collected by the station was used in planning the daily activities and setup locations, as well as analyzed to determine trends of air movement at the site.

The meteorological station was equipped with sensors to monitor the following parameter:

- Temperature
- Humidity
- Wind Direction
- Wind Speed

The sensors were located at the job trailer and elevated approximately 5 meters above the ground surface. The sensors were positioned onsite in such a manner to minimize interference from nearby terrain while allowing for access to the measuring equipment. Review of data collected indicates that the wind direction is primarily from the north direct. This generally appeared consistent throughout the project with occasional fluctuations in the winds blowing from the east.

5.0 Results and Findings

Analytical and monitoring data has been summarized and is contained in Table 3.0. Table 3.0 outlines the date and type of monitoring and sampling conducted and summarizes the maximum air concentration observed during the air sampling and monitoring.

5.1 Sampling

Sampling was conducted for aniline and n-nitrosophenylamine. In all cases, including the baseline and the intrusive activity sampling event, the concentrations of aniline and n-nitrosodiphenylamine were below detection limits.

5.2 Monitoring

5.2.1 VOLATILE ORGANIC COMPOUNDS (VOCs)

Monitoring was conducted for total VOCs. In all cases, including the baseline and the intrusive activity sampling event, the concentrations of VOCs were below detection limit, less than 0.1 ppmv.

5.2.2 DUSTS

Monitoring was conducted for dusts. Table 3.0 outlines the maximum concentration observed during the field activities. In the majority of the monitoring events conducted as part of the baseline and the intrusive activity sampling event, the concentrations of dusts at the perimeter and within the work zone were relatively the same.

On September 16, the downwind location at the East station recorded a maximum concentration of 0.762 ug/m³. However, the overall average concentration at that station was 0.054 ug/m³. As discussed earlier, the east location was in close proximity to the access road for the site, as well as the plant road used by general traffic. It is likely that the isolated periods of dusts is attributable to the picking up and dropping off of rolloff containers for the excavation activities.

6.0 Air Sampling and Monitoring Quality Assurance / Quality Control

All instruments and equipment were calibrated, operated and maintained in accordance with manufacturer's instructions and good industrial hygiene practices. Monitoring instruments were calibrated both before and after monitoring event. Air sampling pumps were also calibrated both before and after sample collection to determine air volume sampled, as well as to ensure the proper operation of the pump. Flow rate calibration was conducted utilizing a primary flow calibrator with inline sample media.

All calibrations were recorded by the SHSO, or his/her designee. All calibrations of instrumentation were observed to be within normal operating parameters. Laboratories contracted to conduct analysis of the air samples collected during this project are AIHA accredited laboratories in good standing.

Due to the limited demand for analysis of N-Nitrosodiphenylamine, few laboratories in the United States are equipped to analyze for N-Nitrosodiphenylamine. As a result, Spectrum Analytical subcontracted this analysis to Goodyear's Industrial Hygiene Laboratory in Ohio. Just prior to receipt of the samples, Goodyear's laboratory experienced equipment failure on the only instrument equipped to conduct this analysis. Attempts were made to contract an alternative laboratory for the analysis of the samples. However, no other laboratories were available. The samples were maintained at the Goodyear facility until analysis approximately 30 days later, when equipment was returned to operations status.

TABLE 3.0
AIR MONITORING AND SAMPLING EVENT RESULTS

TABLE 3.0							
AIR MONITORING AND SAMPLING EVENT RESULTS							
Event	Date	Type	Target	Instrumentation	Location	Designation	Max Observed
Baseline	Aug 28	Real Time Monitoring	Dusts	MIE DataRam	North	Upwind	0.0117 mg/m3
					South	Downwind	0.291 mg/m3
					East	Downwind	0.585 mg/m3
					Work Area	-	0.408 mg/m3
		Real Time Monitoring	Total VOCs	Perkin Elmer Photo Vac 2020 or equivalent	North	Upwind	0 ppm
					South	Downwind	0 ppm
					East	Downwind	0 ppm
		Work Area	-	0 ppm			
		Sample Collection	N-Nitrosodiphenylamine	Low Flow Sampling Pump	North	Upwind	ND (<0.017 ug/m ³)
					South	Downwind	ND (<0.018 ug/m ³)
East	Downwind				ND (<0.018 ug/m ³)		
Work Area / Perimeter	Aug 29	Sample Collection	Aniline	Low Flow Sampling Pump	North	Upwind	ND (<0.018 mg/m ³)
					South	Downwind	ND (<0.017 mg/m ³)
					East	Downwind	ND (<0.018 mg/m ³)
		Sample Collection	Aniline	Low Flow Sampling Pump	North	Upwind	ND (<0.31 mg/m ³)
					South	Downwind	ND (<0.34 mg/m ³)
					East	Downwind	ND (<0.34 mg/m ³)
		Sample Collection	Aniline	Low Flow Sampling Pump	North	Upwind	ND (<0.67 mg/m ³)
					South	Downwind	ND (<0.91 mg/m ³)
					East	Downwind	ND (<1.0 mg/m ³)
					Work Area	-	ND (<0.55 mg/m ³) ND (<0.19mg/m ³)
Sample Collection	N-Nitrosodiphenylamine	Low Flow Sampling Pump	North	Upwind	ND (<0.055 ug/m ³)		
			South	Downwind	ND (<0.042 ug/m ³)		
			East	Downwind	ND (<0.054 ug/m ³)		
Work Area	-	ND (<0.046 ug/m ³)					
Work Area / Perimeter	Aug 29	Real Time Monitoring	Total VOCs	Perkin Elmer Photo Vac 2020 or equivalent	North	Upwind	0 ppm
					South	Downwind	0 ppm
					East	Downwind	0 ppm
					Work Area	-	0 ppm
		Sample Collection	Aniline	Low Flow Sampling Pump	North	Upwind	ND (<0.67 mg/m ³)
					South	Downwind	ND (<0.91 mg/m ³)
					East	Downwind	ND (<1.0 mg/m ³)
		Work Area	-	ND (<0.55 mg/m ³) ND (<0.19mg/m ³)			
		Sample Collection	N-Nitrosodiphenylamine	Low Flow Sampling Pump	North	Upwind	ND (<0.055 ug/m ³)
					South	Downwind	ND (<0.042 ug/m ³)
East	Downwind				ND (<0.054 ug/m ³)		
Work Area	-	ND (<0.046 ug/m ³)					

TABLE 3.0
AIR MONITORING AND SAMPLING EVENT RESULTS

Event	Date	Type	Target	Instrumentation	Location	Designation	Max Observed
		Real Time Monitoring	Dusts	MIE DataRam	North	Upwind	0.059 mg/m ³
					South	Downwind	0.083 mg/m ³
					East	Downwind	0.004 mg/m ³
					Work Area	-	0.069 mg/m ³
Work Area / Perimeter	Sept 16	Real Time Monitoring	Dusts	MIE DataRam-2000 or equivalent	North	Upwind	0.184 mg/m ³
					South	Downwind	0.110 mg/m ³
					East	Downwind	0.762 mg/m ³
					Work Area	-	0.361 mg/m ³
		Real Time Monitoring	Total VOCs	Perkin Elmer PhotoVac 2020 or equivalent	North	Upwind	0 ppm
					South	Downwind	0 ppm
					East	Downwind	0 ppm
					Work Area	-	0 ppm
		Sample Collection	Aniline	Low Flow Sampling Pump	North	Upwind	ND (<0.35 mg/m ³)
					South	Downwind	ND (<0.22 mg/m ³)
					East	Downwind	ND (<0.23 mg/m ³)
					Work Area	-	ND (<0.17 mg/m ³)
		Sample Collection	N-Nitrosodiphenylamine	Low Flow Sampling Pump	North	Upwind	ND (<0.019 ug/m ³)
					South	Downwind	ND (<0.013 ug/m ³)
					East / Work Area	Downwind	ND (<0.014 ug/m ³)
					Work Area	-	0.244 mg/m ³
Work Area / Perimeter	Sept 17	Real Time Monitoring	Dusts	MIE DataRam-2000 or equivalent	North	Downwind	0.267 mg/m ³
					East	Upwind	0.395mg/m ³
					South	Downwind	0.375mg/m ³
					Work Area	-	0.094 mg/m ³
		Real Time Monitoring	Total VOCs	Perkin Elmer PhotoVac 2020 or equivalent	North	Downwind	0 ppm
					East	Upwind	0 ppm
					South	Downwind	0 ppm
					Work Area	-	0 ppm

TABLE 3.0
AIR MONITORING AND SAMPLING EVENT RESULTS

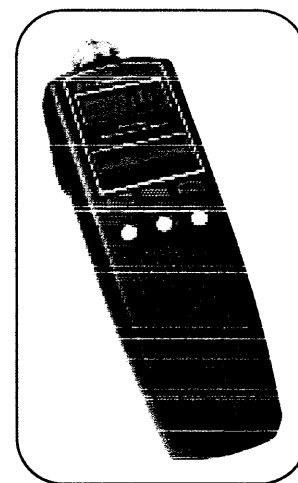
Event	Date	Type	Target	Instrumentation	Location	Designation	Max Observed
		Sample Collection	Aniline	Low Flow Sampling Pump	North	Downwind	ND (<0.16 mg/m ³)
					South	Downwind	ND (<0.22 mg/m ³)
					East	Upwind	ND (<0.23 mg/m ³)
					Work Area	-	ND (<0.17 mg/m ³)
		Sample Collection	N-Nitrosodiphenylamine	Low Flow Sampling Pump	North	Downwind	ND (<0.012 ug/m ³)
					South	Downwind	ND (<0.012 ug/m ³)
					East	Upwind	ND (<0.012 ug/m ³)
					Work Area	-	ND (<0.016 ug/m ³)



Photovac

2020 PHOTOIONIZATION AIR MONITOR

Size	25.4 cm (10") long, 7.6 cm, (3") wide, 5 cm (2") high
Weight	0.8 kg (1.75 lbs.)
Detector	Instant on photoionization detector with standard 10.6eV UV lamp, optional 11.7 eV lamp available
Keypad	6 keys, 3 function keys and 3 menu keys
Status Display	2-line, 16-character dot-matrix, backlit, liquid crystal display for alphanumeric readouts and menu key display
Meter Display	4-digit for real-time concentration readout with backlight
Datalogger Memory	16 kilobytes or 1000 entries
Serial Output	RS – 232, 9600 baud, 8 data bits with no parity, for tabular and graphic printouts and connection to Windows® based PC
Audio Output	95 decibels @ 2048Hz, on Alarm
Inlet Connection	1/8" compression fitting
Operating Temperature Range	0°C to 40°C (32°F to 105°F)
Operating Humidity Range	0 to 100% relative humidity (non-condensing)
Operating Concentration Range	0.5 ppm to 2000 ppm isobutylene equivalent
Response Time	Less than 3 seconds, to 90%
Accuracy	± 10 % or ± 2 ppm, whichever is greater
Low Detection Limit	0.5 ppm isobutylene
Intrinsic Safety	Class I, Division 1, Groups A, B, C, & D Zone 1 locations, Eex ib m IIC T4, Demko No. 95D 119 472



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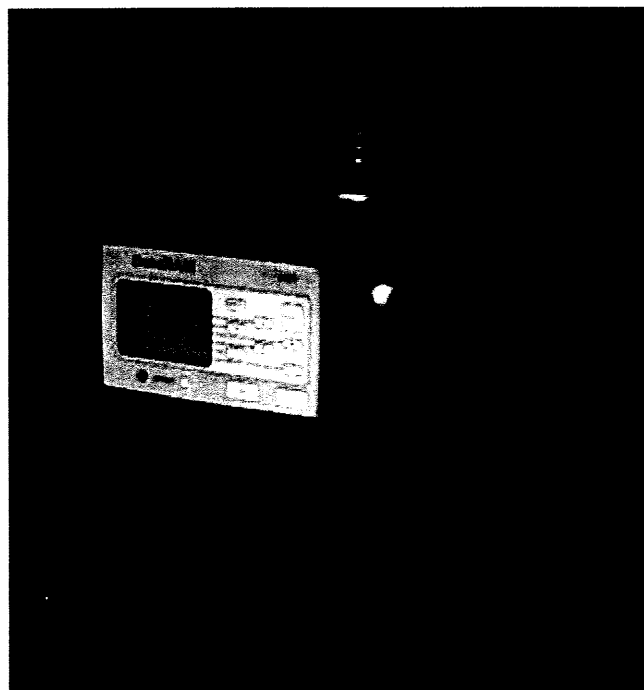
■ PORTABLE MONITOR/DATA LOGGER

DataRAM™

The World's Most Precise and Versatile Real-Time Aerosol Monitor

Real-Time measurement of Airborne particulate Concentrations

With the DataRAM™, you'll never again have to wait for laboratory results to assess whether airborne pollutants have reached dangerous levels. The DataRAM Real-Time Aerosol Monitor measures mass concentrations of airborne dust, smoke, mists, haze, and fumes and provides continuous real-time readouts. Large capacity onboard data logging capability lets you save concentration data for future analysis. With optional accessories, the DataRAM can also provide respirable, PM-2.5, or PM-10 correlated measurements. For exposure sampling or continuous unattended indoor air, ambient, duct, or process monitoring, no other aerosol monitor is as fast, accurate, and easy to use as the DataRAM.



Designed for High Sensitivity

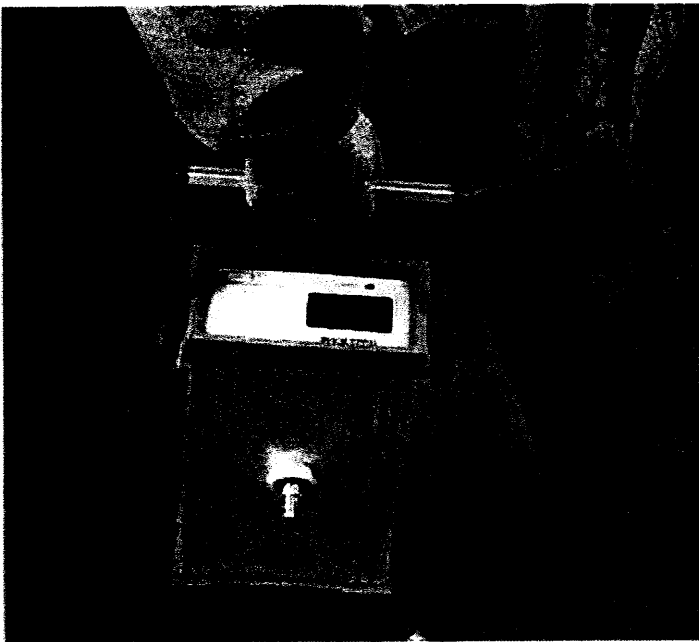
A high-sensitivity nephelometric monitor, the DataRAM samples the air

The Widest Measurement Range of Any Real-Time Particulate Monitor

In addition to its high sensitivity, the

at a constant, regulated flow rate by means of a built-in diaphragm pump. The DataRAM's light scattering configuration is optimized for the measurement of airborne particle concentrations, maximizing the unit's sensitivity. The detected signal is processed by state-of-the-art lock-in circuitry followed by high-resolution digitization, achieving ultimate detectability of atmospheric Rayleigh scattering fluctuations.

DataRAM has the widest measurement range of any real-time aerosol monitor- from 0.0001 mg/m^3 ($0.1 \mu\text{g/m}^3$) to 400 mg/m^3 . With a total span of almost 7 decades, the DataRAM is capable of effectively, measuring mass concentrations of airborne particles in industrial and ambient environments ranging from exceptionally pristine to extremely polluted. The instrument can also be used for atmospheric visibility measurements over a wide range of scattering coefficients. (0.00015 to 600 km^{-1}). The DataRAM's auto-ranging digital display provides both real-time and time averaged concentrations.



DataRAM with Omnidirectional Sampling Inlet for ambient monitoring

Exceptional Long-Term Stability

The dataRAM incorporates several technological advances which guarantee exceptional long-term stability. Near infrared source

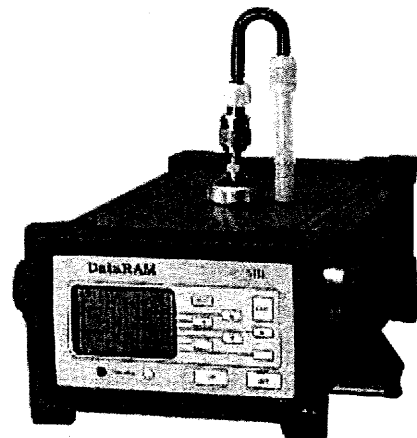
Maintenance-Free Operation

After passing through the optical sensing stage, all the particles are retained

output feedback control provides drift-free operation and excellent temperature stability. For either manual or preprogrammed/automatic zeroing of the monitor, an electronically controlled latching solenoid valve diverts the entire filtered air stream through the optical sensing stage in order to achieve "zero" air reference. In addition, instrument span checks (secondary calibration) can be performed simply by turning a knob on the DataRAM's back panel, which inserts a built-in optical scattering/diffusing element into the filtered air stream. On-screen diagnostic indicators and automatic shut-off for low battery conditions also help ensure the monitor's correct operation and data storage.

on a HEPA filter. Part of the filtered air stream is then continuously diverted through and over all optically-sensitive areas (lens, light traps, etc.) to form a continuous air curtain which protects against particle deposition.

This design, in conjunction with a highly reliable diaphragm pump, ensures long-term maintenance-free operation. A membrane filter (with special holder included) can be substituted for the HEPA cartridge for gravimetric and/or chemical analysis of the particles collected downstream of the sensing stage.



*DataRAM with Cyclone
Precollector for respirable
particle measurements*

Menu-Driven Information Displays

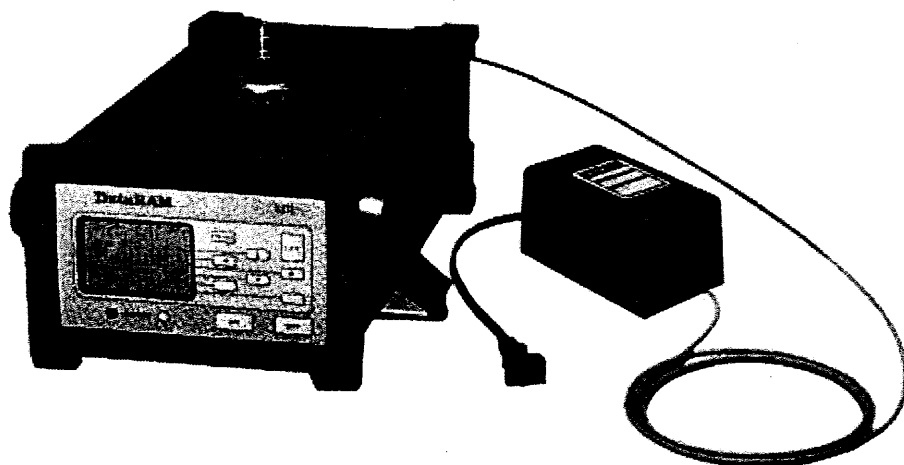
In addition to the auto-ranging real-time concentration readout, the DataRAM provides users with a variety of informational displays on its 8-line LCD screen. Real-time and date, time-weighted average concentrations, elapsed run times, and other information are easily viewed by selecting the appropriate screen

Integral Large-Capacity Data Logger

The DataRAM has built-in large-capacity data logging capabilities. Stored information includes time and date, average concentrations, maximum and minimum values over selected periods, STEL concentration, and tagging codes. Logged information can be retrieved either by scrolling through the

using a scroll-through menu. Operating parameters and diagnostic information displays can also be easily accessed through the menu using only 6 keys on the front of the instrument.

DataRAM's display or by down-loading to an external device such as a personal computer or printer.



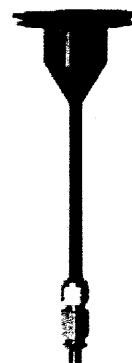
DataRAM can be powered by a rechargeable internal battery or an external power source

Digital, Analog, and Alarm Outputs

The DataRAM provides continuous digital output (by means of an RS232C data port) as well as analog output, and a switched output for selectable high-level alarm with a built-in audible signal.

Accessories Expand Versatility and Enhance Accuracy

Several optional accessories are available for use with the DataRAM for a wide range of sampling applications. A cyclone precollector allows respirable particle measurements. An omnidirectional air sampling inlet (with or without a PM-10/2.5 head) is available for ambient



monitoring.
Isokinetic inlet nozzles are available for duct sampling. An in-line heater module allows accurate monitoring of solid particles in high humidity/fog conditions. A sample dilution accessory permits elevated temperature and/or very high concentration monitoring. To down-load data to a PC or laptop any standard serial communications software package (e.g. Microsoft Windows™ 3.1) can be used. Standard spreadsheet packages (such as Microsoft Excel™, Lotus™, and others) can easily access and analyze data log files transmitted to a PC for review and archiving. A portable battery-powered printer and cabling accessories are also available.

*DataRAM with
In-Line Heater for
monitoring in high
humidity or fog*

Specifications

Elapsed time range: 1 second to 99 days

Time keeping and data storage duration: > 10 years

Readout display: LCD
120 x 64 dots, 15 characters
x 8 lines, 57.6 x 38.4 mm
active area

Concentration measurement ranges

Internal battery:

(auto-ranging)¹:

0.1 to 999.9 $\mu\text{g}/\text{m}^3$ (resolution: $0.1\mu\text{g}/\text{m}^3$)

1.00 to 39.99 $\mu\text{g}/\text{m}^3$ (resolution: $0.01\text{mg}/\text{m}^3$)

40.0 to 399.9 mg/m^3 (resolution: $0.1\text{mg}/\text{m}^3$)

Scattering coefficient range: 1.5×10^{-7} to $6 \times 10^{-1} \text{ m}^{-1}$ (approximate) @ $\lambda = 880 \text{ nm}$

Concentration display

averaging/updating interval²:

1 or 10 seconds

Precision/repeatability over 1 hour (2-sigma)³:

$\pm 0.3 \mu\text{g}/\text{m}^3$ for 10 second averaging

$\pm 1.0 \mu\text{g}/\text{m}^3$ for 1 second averaging

Accuracy¹: $\pm 5\%$ of reading \pm precision

Particle size range of maximum

response : 0.1 to $10\mu\text{m}$

Sampling flow rate²: 1.7 to 2.3 liters/minute

Alarm level adjustment range²: 0.1

$\mu\text{g}/\text{m}^3$ to $399.9 \text{ mg}/\text{m}^3$

Alarm averaging time : real time (1 or 10

seconds),

or STEL (15 minutes)

Data logging averaging periods²: 1

second to 4 hours

Total number of data points in memory:

10,000 (each point: average, minimum, and maximum concentrations)

Logged data:

- For each data point: average, minimum, and maximum concentrations; time/date; and data point number
- Run summary: tag number of logged points; start time/date; total elapsed run time; averaging time; data logging averaging period; calibration

rechargeable sealed lead-acid; 6.5 Ahr; 6 V nominal

Operating time with new and initial full

battery charge⁴: > 24 hours

Operating time with DataRAM charger:

continuous and unlimited

Charging input power:

115/230 VAC, 50/60 Hz, 50 VA

External DC power (optional): 6 V @ 3 A

Analog output (auto ranging)⁵:

0 to 5 V, for 0 to $4 \text{ mg}/\text{m}^3$

0.5 to 5 V, for 4 to $40 \text{ mg}/\text{m}^3$

0.5 to 5 V, for 40 to $400 \text{ mg}/\text{m}^3$

Digital output: RS232C,

9600 baud; 8 data bits, 1

stop bit; parity: none

Alarm output: switched.

1 A @ 10 V maximum,

resistance < 0.1Ω

Alarm sound intensity:

90 dB @ 1 m

Fuse: 1 A, fast

Operating

environment: 0° to 40° C

(32° to 104° F), 0 to 95%

RH, noncondensing

Storage environment: -

20° to 60° C (-4° to 140° F)

factor; STEL concentration; STEL occurrence time after start; overall average concentration; overall maximum and minimum concentrations with data point number

Number of data tags: 10

Real time and date data: seconds; minutes; hours; day of month; month and year (with leap year compensation)

Clock accuracy: ± 1 minute/month, or better

Dimensions:

134 mm (5.28 in) H x 184 mm (7.25 in) W x 346 mm (13.63 in) D

Weight: 5.3 kg (11.7 lbs)

Standard accessories included:

universal voltage battery charger, standard HEPA filter cartridge, analytical filter holder, PC communications software disk, digital output cable, carrying case, and instruction manual

1 referred to gravimetric calibration with AC Fine test dust

2 User selectable

3 At constant temperature

4 At 25 ° C

5 Range identified on LCD screen



Also see Technical and Application notes on the DataRAM™

Get the latest Software DataRAM *version*

For more information, request
DataRAM™ Brochure

REAGENTS:

1. Dichloromethane, reagent grade.
2. Methanol, reagent grade.
3. Nitrogen, purified.
4. Oxygen, purified, 99.99%.
5. Standardsolutions of N-nitrosodimethylamine, N-nitrosodiethylamine, N-nitrosodibutylamine, N-nitrosodipropylamine, N-nitrosomorpholine, N-nitrosopiperidine, N-nitrosopyrrolidine.
6. Eluent, 3:1 (v/v) dichloromethane/methanol.
7. Air, filtered, compressed.
8. Ozone, purified 99.99%.

* See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: Commercially available tubes (Thermedics Detection, Inc., 220 Mill Rd., Chelmsford, MA 01824, 508/251-2000).
2. Personal sampling pump, 0.2 to 2 L/min, with flexible tubing.
3. Gas chromatograph equipped with thermal energy analyzer (TEA), integrator and column (page 2522-1).
4. Vials, glass, 2-mL, PTFE-lined crimp caps.
5. Pipets, various sizes for preparing standards.
6. Syringes, 1-, 5-, 10-, 25-, and 100- μ L readable to 0.1 μ L.
7. Volumetric flasks, 10-mL.
8. Gloves for safe handling of toxic chemicals.
9. Syringe, glass, 5.0-mL, with male Luer adapter.
10. Needle, industrial blunt, 20-gauge with female luer adapters.

SPECIAL PRECAUTIONS:

N-nitrosodimethylamine is an OSHA-regulated carcinogen. Other nitrosamines are suspected carcinogens and are very toxic. Handle samples and standards in a well-ventilated hood or glove box.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Remove the Thermosorb/N tube from the foil pouch. Save the pouch.
3. Remove the red end caps from the inlet and outlet ports. Store red caps on the Thermosorb/N tube in the brackets under the "AIR IN" sign.
4. Label the Thermosorb/N tube with the peel-off "AIR SAMPLER" label provided on the foil pouch.
5. Attach the Thermosorb/N tube to the sampling pump with flexible tubing.
6. Sample at an accurately known flow rate between 0.2 and 2 L/min for a total sample size of 15 to 1000 L.
7. After sampling, detach the sampler from the pump.
8. Replace the red end caps on the inlet and outlet ports of the sampler.
9. Replace the Thermosorb/N tube in the foil pouch. Fold the pouch and seal it with the clip provided and pack securely for shipment.

SAMPLE PREPARATION:

10. Remove the sampler from the foil pouch.
11. Label analysis vial with the label from the Thermosorb/N air sampler.
12. Remove the red end-caps, store them in the bracket provided with the tube.
13. Attach a syringe needle to the male Luer fitting of the Thermosorb/N tube.
14. Attach a syringe barrel containing eluent to the female Luer fitting of the Thermosorb/N tube.
15. Elute by "backflushing" the Thermosorb/N tube with 2.0 mL of eluent. Collect the effluent in the labeled vial.

NOTE: The optimum elution rate is 0.5 mL/min.

CALIBRATION AND QUALITY CONTROL:

16. Calibrate daily with at least six working standards over the range of 0.05 to 0.5 µg of analyte per sample (0.025 to 0.25 µg/mL).
 - a. Add known amounts of the nitrosamines standard solution to eluent in 10-mL volumetric flasks and dilute to mark.
 - b. Analyze together with samples and blanks (steps 19-22).
 - c. Prepare calibration graph (peak area of analyte vs. µg analyte).
17. Determine desorption efficiency (DE) at least once for each batch of Thermosorb/N tubes used.
 - a. Inject a known amount of nitrosamine standard solution directly onto the Thermosorb/N tube with a microliter syringe.
 - b. Cap the tube. Allow to stand overnight.
 - c. Desorb (steps 12 through 15) and analyze together with working standards (steps 19 through 22).
 - d. Prepare a graph of DE vs. µg analyte recovered.
18. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

MEASUREMENT:

19. Set gas chromatograph and TEA to the conditions listed on page 2522-1.
20. Inject sample aliquot manually, using solvent flush technique or with an autosampler.
21. Approximate retention times of the seven nitrosamines at indicated column temperatures are:

<u>COMPOUND</u>	<u>COLUMN TEMP. °C</u>	<u>RETENTION TIME (MIN)</u>
<u>N</u> -nitrosodimethylamine	120	2.2
<u>N</u> -nitrosodiethylamine	125	3.1
<u>N</u> -nitrosodipropylamine	142	6.2
<u>N</u> -nitrosodibutylamine	145	7.4
<u>N</u> -nitrosomorpholine	178	13.2
<u>N</u> -nitrosopiperidine	169	12.0
<u>N</u> -nitrosopyrrolidine	166	11.2

22. Measure peak area.

CALCULATIONS:

23. Determine the mass, µg (corrected for DE) of analyte found in the sample (W) and blank (B).
24. Calculate concentration, C, analyte in the air volume sampled, V (L):

$$C = \frac{W - B}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

The method was evaluated over the range 0.05 to 0.5 µg of the seven nitrosamines per sample. Desorption efficiency was checked by spiking known amounts of the compounds on Thermosorb/N tubes and was found to be nearly 100% for all nitrosamines studied. The sampling device is small and interferences are minimal; large concentrations can be sampled (up to 1500 µg loading) with no breakthrough. Samples can be stored at room temperature for long periods of time (≥ 6 weeks). Some field samples were also used for evaluation of this method [2].

REFERENCES:

Table 1

MW: Table 1

CAS: Table 1

RTECS: Table 1

METHOD: 2522, Issue 2

EVALUATION: PARTIAL

Issue 1: 15 May 1989

Issue 2: 15 August 1994

OSHA : no PELs; N-nitrosodimethylamine is a carcinogen
 NIOSH: no RELs; N-nitrosodimethylamine is suspect carcinogen
 ACGIH: no TLVs; N-nitrosodimethylamine is suspect carcinogen

PROPERTIES: Table 1

SYNONYMS: Table 1.

SAMPLING		MEASUREMENT	
SAMPLER:	SOLID SORBENT TUBE (Thermosorb/N™ air sampler)	TECHNIQUE:	GAS CHROMATOGRAPHY, TEA [1]
FLOW RATE:	0.2 to 2 L/min	ANALYTE:	nitrosamines (Table 1)
VOL-MIN:	15 L @ 10 µg/m ³	DESORPTION:	2 mL 3:1 (v/v) dichloromethane/ methanol; stand 30 min
-MAX:	1000 L	INJECTION VOLUME:	5 µL
SHIPMENT:	routine	COLUMN:	stainless steel (10 in x $\frac{1}{8}$ in); 10% Carbowax 20M + 2% KOH on Chromosorb W-AW
SAMPLE STABILITY:	at least 6 weeks @ 20 °C [1,2]	TEMPERATURE-INJECTION:	200 °C
BLANKS:	2 to 10 field blanks per set	-DETECTOR:	550 °C to 600 °C
		-COLUMN:	110 °C to 200 °C programmed @ 5°/min
ACCURACY		GASES:	N ₂ carrier, 25 mL/min; oxygen, 5 mL/min; ozone, 0.2 mL/min
RANGE STUDIED:	not studied	CALIBRATION:	standard solutions of analytes in methanol/dichloromethane
BIAS:	not determined	RANGE:	0.15 to 0.5 µg per sample [2]
OVERALL PRECISION (\bar{S}_{rT}):	not determined	ESTIMATED LOD:	0.05 µg per sample [2]
ACCURACY:	not determined	PRECISION (\bar{S}_r):	0.014 @ 0.05 to 0.4 µg per sample [2]

APPLICABILITY: The working range is 0.003 to 10 mg/m³ for a 50-L air sample. If high ambient concentrations of nitrosamines are expected, another Thermosorb/N tube should be used as a back-up in sampling.

INTERFERENCES: When the thermal energy analyzer (TEA) is operated in the nitrosamine mode, it is highly specific for N-nitroso compounds. Because of the TEA's selectivity and sensitivity, it is possible to chromatograph and quantitate N-nitroso compounds, even in the presence of other co-eluting compounds. Therefore, there is little or no interference from other compounds.

OTHER METHODS: This replaces NIOSH methods P&CAM 252 [3] and P&CAM 299 [4].

- [1] Roundbehrer, D. and Fajen J. N-Nitroso Compounds in the Factory Environment, NIOSH contract #210-77-0100 (1977).
- [2] Foley, D. NIOSH/MRSB Method Development Efforts, Backup Data Report and Analysis for Nitrosamines, NIOSH, (Unpublished, 1983-1988).
- [3] NIOSH Manual of Analytical Methods, 2nd ed., V. 1, P&CAM 252, U.S. Department of Health Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).
- [4] Ibid., V.5, P&CAM 299, NIOSH Publ. 79-141 (1979).

METHOD WRITTEN BY: G. David Foley, NIOSH/DPSE.

Table 1: General Information

Compounds (Synonyms)	Formula	MW	Properties
<u>N</u> -nitrosodimethylamine (<u>N</u> -Methyl- <u>N</u> -nitrosomethanamine; dimethylnitrosamine; DMN; DMNA; CAS #62-75-9) RTECS: IQ0525000	$(\text{CH}_3)_2\text{N-N=O}$	74.1	liquid; d 1.00 g/mL @ 20 °C; BP 151 °C; VP 0.36 kPa (2.7 mm Hg) @ 20 °C
<u>N</u> -nitrosodiethylamine (<u>N</u> -Ethyl- <u>N</u> -nitrosoethanamine; diethylnitrosamine; DEN; DENA; CAS #55-18-5) RTECS: IA3500000	$(\text{C}_2\text{H}_5)_2\text{N-N=O}$	102.1	liquid, d 0.94 g/mL @ 20 °C; BP 175 °C; VP 0.1 kPa (0.86 mm Hg) @ 20 °C
<u>N</u> -nitrosodipropylamine (<u>N</u> -Propyl- <u>N</u> -nitrosopropylamine DPN; DPNA; CAS #621-64-7) RTECS: JL9700000	$(\text{C}_3\text{H}_7)_2\text{N-N=O}$	130.2	liquid; d 0.916 g mL/@ 20 °C; BP 194.5 °C; VP 11 Pa (0.085 mm Hg) @ 20 °C
<u>N</u> -nitrosodibutylamine (<u>N</u> -Butyl- <u>N</u> -nitrosobutylamine; dibutylnitrosamine; CAS #924-16-3) RTECS: EJ4025000	$(\text{C}_4\text{H}_9)_2\text{N-N=O}$	158.3	liquid; d 9.901 g/mL @ 20 °C; BP 116 °C @ 14 mm Hg, VP 4 Pa (0.03 mm Hg) @ 20 °C
<u>N</u> -nitrosomorpholine (NMOR; 4-Nitrosomorpholine; MORNA; CAS #59-89-2) RTECS: QE7525000	$\text{C}_4\text{H}_8\text{N}_2\text{O}_2$	116.1	liquid/crystals; d unknown; BP 225 °C; MP 29 °C; VP unknown
<u>N</u> -nitrosopiperidine (<u>N</u> -NPIP; PIPNA; NPIP; CAS #100-75-4) RTECS: TN2100000	$(\text{CH}_2)_5\text{N-N=O}$	114.2	liquid; d 1.063 @ 19 °C; BP 217 °C @ 720 mm Hg; VP unknown
<u>N</u> -nitrosopyrrolidine (<u>N</u> -NPyr; NPYR, PYRNA; 1-Nitrosopynolodine; CAS #930-55-2) RTECS: UY1575000	$\text{C}_4\text{H}_8\text{N-N=O}$	100.1	liquid; d 1.09 g/mL @ 20 °C; BP 214 °C; VP 10 Pa (0.072 mm Hg) @ 20 °C

Table 1

MW: Table 1

CAS: Table 2

RTECS: Table 2

METHOD: 2002, Issue 2

EVALUATION: FULL (1-3); PARTIAL (4,5)

Issue 1: 15 May 1985

Issue 2: 15 August 1994

OSHA : Table 2

NIOSH: Table 2

ACGIH: Table 2

PROPERTIES: Table 1

SYNONYMS: (1) aniline: benzenamine; aminobenzene; phenylamine
 (2) *o*-toluidine: 2-aminotoluene
 (3) 2,4-xylydine: 2,4-dimethylaniline; dimethylaminobenzene
 (4) N,N-dimethyl-*p*-toluidine: *p*-dimethylaminotoluene
 (5) N,N-dimethylaniline: N,N-dimethylbenzeneamine

SAMPLING		MEASUREMENT	
SAMPLER:	SOLID SORBENT TUBE (silica gel, 150 mg/75 mg)	TECHNIQUE:	GAS CHROMATOGRAPHY, FID
FLOW RATE:	Table 2	ANALYTE:	amines listed above
VOL-MIN:	Table 2	DESORPTION:	1 mL 95% ethanol; 1 h in ultrasonic bath
-MAX:	Table 2	INJECTION VOLUME:	5 µL
SHIPMENT:	routine	CARRIER GAS:	N ₂ or He, 25 mL/min
SAMPLE STABILITY:	(1), (2), and (3) stable for ≥ 7 days [1]; stability data not available for (4) and (5)	COLUMN:	stainless steel, 0.6 m x 3-mm OD, packed with 80/100 mesh Chromosorb 103
BLANKS:	2 to 10 field blanks per set	CALIBRATION:	standard solutions of analytes in 95% ethanol
ACCURACY		RANGE:	0.1 to 3 mg per sample
RANGE STUDIED:	see EVALUATION OF METHOD	ESTIMATED LOD:	0.01 mg per sample [2]; not determined for (3)
BIAS:	see EVALUATION OF METHOD	PRECISION (\bar{S}_p):	see EVALUATION OF METHOD
OVERALL PRECISION ($\bar{S}_{r,T}$):	see EVALUATION OF METHOD		
ACCURACY:	see EVALUATION OF METHOD		

APPLICABILITY: See Table 2 for working ranges. A modification of this method has been used for aniline and *o*-toluidine at a vulcanized rubber manufacturing plant [2]. Applicability of this method for simultaneous determination of the analytes has not been investigated. A nitrogen-specific GC detector instead of an FID will greatly increase sensitivity.

INTERFERENCES: None known. Silica gel has reduced capacity for organic compounds at high humidity.

OTHER METHODS: This combines Methods S162 (xylydine) [3], S164 (dimethylaniline) [3], S168 (*o*-toluidine) [3], S310 (aniline) [3], P&CAM 280 (N,N-dimethyl-*p*-toluidine) [4], and P&CAM 168 (aromatic amines) [5,6].

REAGENTS:

1. Ethanol, 95%, non-denatured, chromatographic quality.
2. n-Hexane.
3. Benzene.*
4. Analytes, reagent grade.*
5. Aniline calibration stock solution, 102.2 mg/mL.* Dissolve 1 mL aniline in 2 mL benzene; dilute to 10 mL with hexane.
NOTE: Benzene possibly could be replaced with toluene, alcohol, or acetone to minimize the analyst's exposure to suspect carcinogens. Effects of this substitution are not known and should be tested.
6. o-Toluidine calibration stock solution, 100.6 mg/mL.* Dilute 1 mL o-toluidine to 10 mL with n-hexane.
7. 2,4-Xylidine calibration stock solution, 97.8 mg/mL.* Dilute 1 mL 2,4-xylidine to 10 mL with n-hexane.
8. N,N-Dimethyl- p-toluidine calibration stock solution, 93.5 mg/mL.* Dilute 1 mL N,N-dimethyl- p-toluidine to 10 mL with n-hexane.
9. N,N-Dimethylaniline calibration stock solution, 95.6 mg/mL.* Dilute 1 mL N,N-dimethylaniline to 10 mL with hexane.
10. Hydrogen, prepurified.
11. Helium, purified.
12. Nitrogen, purified.
13. Air, filtered, compressed.

* See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: glass tube, 7 cm long, 6-mm OD, 4-mm ID; with plastic caps; containing two sections of 20/40 mesh silica gel separated by a 2-mm portion of urethane foam (front = 150 mg; back = 75 mg). For N,N-dimethyl- p-toluidine, a front section of 100 mg and back section of 50 mg may be used. A silylated glass wool plug precedes the front section and a 3-mm urethane foam plug follows the back section. Pressure drop across the tube at 1 L/min airflow must be less than 3.4 kPa. Tubes are commercially available.
2. Personal sampling pump, 0.02 to 1 L/min, with flexible connecting tubing.
3. Gas chromatograph, FID, integrator and column (page 2002-1).
4. Vials, glass, 2-mL, PTFE-lined crimp caps.
5. Syringes, 10-, 25-, 50- and 100- μ L.
6. Pipets, 1- and 2-mL.
7. Ultrasonic bath.
8. File.
9. Tweezers.
10. Flasks, volumetric, 10-mL.

SPECIAL PRECAUTIONS: n-Hexane and ethanol are flammable. Aniline, o-toluidine, 2,4-xylidine, and benzene are suspect carcinogens [7,8]. Absorption through skin is a potential hazard. All work with these chemicals should be performed in a hood. Use proper protective clothing including gloves. Analytes (1), (2), (3), and (5) are severe poisons.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the sampler immediately before sampling. Attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate for a total sample size according to Table 3.
4. Cap the samplers. Pack securely for shipment.

SAMPLE PREPARATION:

5. Place the front and back sorbent sections of the sampler tube in separate vials. Add the glass wool plug to the front sorbent section vial. Discard the foam plugs.
6. Add 1.0 mL 95% ethanol to each vial. Attach crimp cap to each vial.
7. Agitate 1 h in an ultrasonic bath.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate daily with at least six working standards over the range 0.01 to 3 mg analyte per sample.
 - a. Add known amounts of calibration stock solution, or a dilution thereof, in n-hexane to 95% ethanol in 10-mL volumetric flasks and dilute to the mark.
 - b. Analyze together with samples and blanks (steps 11 and 12).
 - c. Prepare calibration graph (peak area or height vs. mg analyte).
9. Determine desorption efficiency (DE) at least once for each lot of silica gel used for sampling in the calibration range. Prepare three tubes at each of five levels plus three media blanks.
 - a. Remove and discard back sorbent section of a media blank sampler.
 - b. Inject a known amount (1 to 20 μ L) of calibration stock solution, or a dilution thereof, in hexane directly onto front sorbent section with a microliter syringe.
 - c. Cap the tube. Allow to stand overnight.
 - d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
 - e. Prepare a graph of DE vs. mg analyte recovered.
10. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

MEASUREMENT:

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 2002-1. Inject sample aliquot manually using solvent flush technique or with autosampler. Use the following conditions as a guide (these were used in development of the methods [1]):

COMPOUND	TEMPERATURES, °C		
	Injection	Column	Detector
Aniline	230	165	245
o-Toluidine	240	180	265
2,4-Xylidine	230	170	235
N,N-Dimethyl- p-toluidine	250	180	250
N,N-Dimethylaniline	150	100 for 4 min, then 8°C/min to 225	250

NOTE: If peak response is above the linear range of the working standards, dilute with 95% ethanol, reanalyze, and apply the appropriate dilution factor in calculations.

12. Measure peak area or height.

CALCULATIONS:

13. Determine the mass, mg (corrected for DE) of analyte found in the sample front (W_f) and back (W_b) sorbent sections, and in the average media blank front (B_f) and back (B_b) sorbent sections.
NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
14. Calculate concentration, C, of analyte in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - B_f - B_b) \cdot 10^3}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

Precisions, biases and recoveries listed below were determined by analyzing generated atmospheres containing one-half, one and two times the OSHA standard [1]. Generated concentrations were independently verified. Breakthrough of the front section of the silica gel tube was not observed after sampling a dry test atmosphere. The first three analytes were stable on silica gel for at least one week. Method S164 using collection on activated charcoal was also developed for N,N-dimethylaniline [3].

Substance	<u>Breakthrough</u> volume in dry air at concentration		Range mg/m ³ (volume)	Bias (%)	Overall Precision (\bar{S}_r)	Accuracy (%)	<u>Measurement</u>		Desorption efficiency
	(L)	(mg/m ³)					Range (mg)	Precision (\bar{S}_r)	
Aniline	>44.4	38	9.5-38.2 (20 L)	-4.9	0.060	±15.1	0.20-0.82	0.013	0.980-1.00
<i>o</i> -Toluidine	>221.3	47	11.7-46.9 (50 L)	-1.5	0.060	±12.0	0.55-2.2	0.032	0.970-0.983
2,4-Xylidine	>44.4	50	12.5-50.0 (20 L)	-1.2	0.057	±11.2	0.25-1.01	0.021	0.959-1.015
N,N-Dimethyl- <i>p</i> -toluidine	*	*	9.4-30.0 (100 L)	*	*	*	0.47	0.035	0.88
N,N-Dimethyl-aniline	*	*	*	-7.9	0.090	±16.0	0.05-3.0	*	0.997 (1.9-mg samples)

*Not determined

REFERENCES:

- [1] Documentation of the NIOSH Validation Tests, S162, S164, S168, S310, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977), available as GPO Stock #017-033-00231-2 from Superintendent of Documents, Washington, DC 20402.
- [2] UBTL, Inc., Sequence #2300-S, Aniline (May 15, 1980), and Sequence #2551-M, *o*-Toluidine (August 28, 1980) (NIOSH, unpublished).
- [3] NIOSH Manual of Analytical Methods, 2nd ed., Vol. 3, S162, S164, S168, S310, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
- [4] Ibid., Vol. 4, P&CAM 280, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-175 (1978).
- [5] Ibid., Vol. 1, P&CAM 168, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).

- [6] Campbell, E. E., G. O. Wood and R. G. Anderson. Los Alamos Scientific Laboratory Progress Reports LA-5104-PR, LA-5164-PR, LA-5308-PR, LA-5389-PR, LA-5484-PR and LA-5634-PR, Los Alamos, NM (November, 1972; January, 1973; June, 1973; August, 1973; December, 1973; and June, 1974).
- [7] Registry of Toxic Effects of Chemical Substances, 1979 eds., Vols. 1 and 2, U.S. Department of Health and Human Services, Publ. (NIOSH) 80-111 (1980).
- [8] NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards, Aniline and *o*-Toluidine, U.S. Department of Health and Human Services, Publ. (NIOSH) 81-123 (1981), available as GPO Stock #017-033-00337-8 from Superintendent of Documents, Washington, DC 20402.

METHOD WRITTEN BY:

Paula Fey O'Connor, Julie R. Okenfuss and George Williamson, NIOSH/DPSE.

TABLE 1. PHYSICAL PROPERTIES AND PERSONAL EXPOSURE LIMITS

Substance Formula	MW	BP (°C)	MP (°C)	d, g/mL @ 20 °C	VP @ 20 °C kPa (mm Hg)	Conversion factor (ppm to mg/m ³ @ NTP)
Aniline; C ₆ H ₇ N	93.13	184	-6	1.022	0.089 (0.3)	3.81
<i>o</i> -Toluidine; C ₇ H ₉ N	107.16	200	-15	1.006	0.043 (0.32)	4.38
2,4-Xylidine; C ₈ H ₁₁ N	121.18	214	-14	0.9723	<0.1 (<1)	4.95
N,N-Dimethyl- <i>p</i> -toluidine; C ₉ H ₁₃ N	135.21	211	NA	0.935	NA	5.53
N,N-Dimethylaniline; C ₈ H ₁₁ N	121.18	192	2	0.956	<0.1 (0.5)	4.95

NA = not available.

TABLE 2. GENERAL INFORMATION.

Substance	CAS	RTECS	OSHA	Exposure Limits (ppm)	
				NIOSH	ACGIH
Aniline	62-53-3	BW6650000	5 (skin)	lowest feasible (carcinogen)	2 (skin)
<i>o</i> -Toluidine	95-53-4	XU2975000	5 (skin)	lowest feasible (carcinogen; skin)	2 (skin) (carcinogen)
2,4-Xylidine	1300-73-8	ZE8575000	5 (skin)	2 (skin)	0.5 (skin)
N,N-Dimethyl- <i>p</i> -toluidine	99-97-8	XU5803000	-----	-----	-----
N,N-Dimethylaniline	121-69-7	BX4275000	5 (skin)	5 TWA; 10 STEL (skin)	5 TWA; 10 STEL (skin)

TABLE 3. SAMPLING FLOW RATES AND VOLUMES.

Substance	Flow Rate (L/min)	SAMPLING Volume (L)		Working Range (mg/m ³)
		MIN	MAX	
Aniline	0.02 - 0.2	5	30	5 - 60 (20-L samples)
<i>o</i> -Toluidine	0.02 - 1.0	10	150	5 - 60 (55-L samples)
2,4-Xylidine	0.02 - 0.2	3	20	3 - 75 (20-L samples)
N,N-Dimethyl- <i>p</i> -toluidine	0.02 - 1.0	*	*	9 - 30 (100-L samples)
N,N-Dimethylaniline	0.02 - 1.0	3	30	1.3 - 79 (38-L samples)

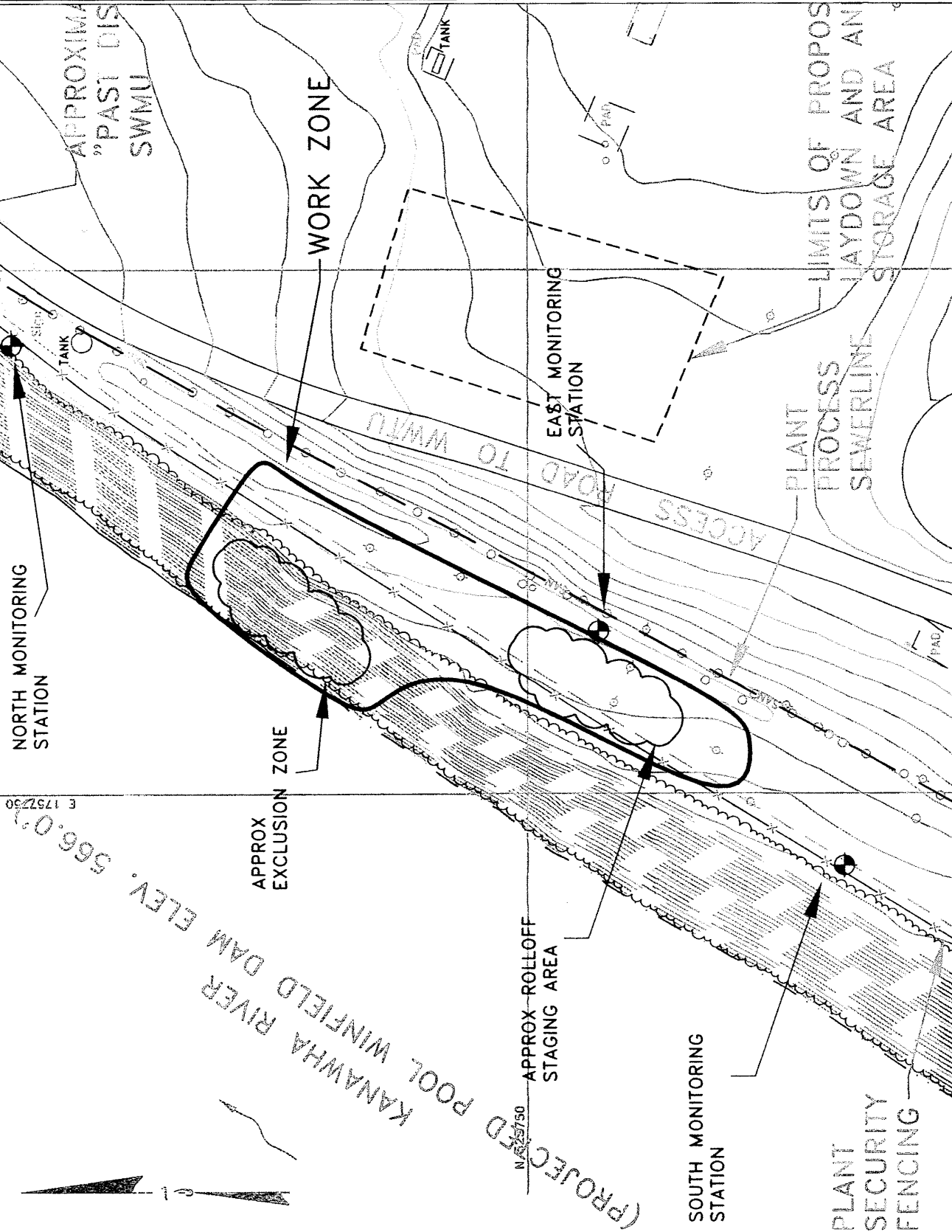
*Not determined.

Notes:
Base Map provided by Potesia and Associates, Inc., Interim Measures
Work Plan, June 2002

Work Zone is area where all operations activities, such as staging
equipment and rollofs during loading, etc., and does not necessarily
reflect excavation area.

N 526000

E 1757250



MAVERICK Construction Management Services, Inc.



SLOPE REPAIR (MP 42.1)
FLEXSYS NITRO FACILITY

PROJECT RECORD

DESIGNED BY: KUL	1
DRAFTED BY:	
CHECKED BY: DRAFT	
FILE:	
PROJECT:	
SHEET NO.	1
SHEET	1 OF

APPENDIX E

Dave Corsaro (Potesta and Associates, Inc.)
Field Notes (9/10/02 through completion of project)
Solutia Bank Stabilization Project
Project No. 01-0081-007.

9/10/02

- 0800-Corsaro on site
- calibrate PID and Personal Data Ram
- work on bank in progress – Fiore informed Corsaro that we are waiting on Nitrodi.....
air sampling and that aniline levels are acceptable. We are currently operating in
Level D
- Corsaro spoke w/Ken Lafferty – Corsaro should periodically record instrument levels in
lieu of data logging
- PID – low battery - will wait to charge
- 1005-took PDR to site
- break finished – Fiore meeting w/workers, explained activities
- asbestos at bottom of landing will not be disturbed
- Fiore will wear PDR in small excavator in exclusion zone
- 1025 – begin site activities (prior to break – site setup activities were performed)
- Fiore using small excavator to clear bench along water's edge for excavator movement
and silt fence installation
- large excavator removing material, placing on plastic at top of bank
- hose at top of bank and hose in EZ to control dust
- 1050-Fiore instructed GJ to place clean (George will inspect) C&D debris along slope at
water's edge to create shelf – stumps and other debris to be placed at top of bank on
plastic – clean C&D debris will be used to fill in holes and test pits
- 1115-not enough water pressure for 2 hoses, went to one hose (in EZ)
- 1125-pulled grey-colored stumps and roots from water's edge and placed in rolloff
- cleaning impacted area to native material – sheen on water – contained by silt curtain
- 1150-stop for break
- 1325-resumed work
- began monitoring w/PID – Fiore will keep in small excavator
- 1340-ran into yellow jacket nest
- Corsaro off site to get spray
- 1440 – sprayed yellow jacket nest – set off PID alarm
- 1340-1445 – placing rip-rap setting off PDR alarm
- 1500-stopped for break
- 1600-resumed work
- 1640-finished excavating for day

9/11/02

- installation of silt fence today
- 0900-calibrated PDR and PID
- 1000-Fiore and 3 Williams personnel into EZ to install silt fence
- 1045-Corsaro air monitoring in work zone

- PID-0.0
PDR-0.000-0.035
- air monitors placed at upriver monitoring station (at bottom of stairs) between monitoring events
 - moving of gravel to toe-in silt fence is creating dust
 - 1115-air monitoring
PID-0.0
PDR-0.010-0.065
 - 1130-break for lunch
 - 1330-resumed work on silt fence
 - 1340-Corsaro spoke w/Chris Grose & Fiore – no work in EZ scheduled tomorrow – EZ now defined by silt fence – consensus that Corsaro does not need to be on site tomorrow (9/12)
 - 1355-air monitoring
PID-0.0
PDR-0.018-0.162
 - 1430-attempted to download PDR – did not set PDR to log – no data to download.
TWA for day is 0.044 mg/m^3
 - 1450-attempted to download PID – did not set PID to log – no data to download
 - 1440-Williams workers completed decon of mini-excavator
 - 1500-began moving rip-rap to top of bank to place on downriver side of silt fence to end of silt curtain
 - 1545-EZ activities completed for day – rest of today and tomorrow – rip-rap to be piled on downstream side of silt fence – no intrusive activity in EZ

9/16/02

- 0730-Corsaro on site – Fiore and Lafferty already on site
- Lafferty calibrating and preparing instruments
- 0950-Lafferty finished setting monitoring stations
- rolloffs set up and ready to begin excavation
- R25047RT – debris rolloff
- R25126RT – debris rolloff
- 1000 George Jones in EZ – modified Level D
- no skiff placed – Fiore stated that it is not necessary if we stay inside silt fence – silt fence is new fall protection
- 1025-Fiore told George Jones not to chew tobacco while in EZ
- 1030-Fiore directing excavation from top of bank
- Corsaro observing from stairs
- 1105-George Jones out of EZ
- 1130-covered rolloffs and removed to PDA
- Corsaro and Lafferty pulled Nitrodi.... air samplers
- 64130 – North – 118 minutes
- 1145-break for lunch
- 1300 back from lunch – Williams excavating – south monitoring station alarm going off
 - Lafferty set alarm higher – no dust issue
- Tim Strickland into EZ – modified Level D

- 1325-Fiore off site to get geotextile fabric
- 1355-Tim Strickland out of EZ
- 1430-excavator dropped stump onto northern (downriver) edge of silt fence – damaged fence
- rolloff R25928RT – soil and debris - tarped and removed from site
- 1435-excavator removed survey stake at top of bank
- 1440-rolloff R25613RT – soil and debris – tarped
- 1445-excavator making at top of bank – placing gravel and material over bank – Corsaro spoke w/GJ about sampling tomorrow and that we don't want material from top of bank place over the bank. He said that he would clear the material upon getting an empty rolloff
- 1500-Fiore to Baker to get rolloff
- 1600-no rollofs at Baker
- Fiore decided to finish remaining rolloff with debris at bottom of slope
- 1615-John, Tim and George (Williams) into EZ – modified Level D
- 1640-Williams personnel out of EZ
- 1700-rolloff R2876RT tarped and removed from area

9/17/02

- 0630-Corsaro on site
- Fiore and Lafferty already on site
- Corsaro labeling rolloff, Lafferty setting up monitoring instruments
- 0740-Williams employee (Tim) in rolloff to line w/poly – Corsaro instructed him not to get into the rolloff, since it is a confined space
- 0800-during daily H&S meeting, Fiore told Williams employees that a rolloff is not a confined space unless it meets all three criteria of confined space
- 0810-begin excavation
- 0845-sheen observed on river upstream of site
- rolloff R25057RT – soil
- 0915-while covering rolloff, John Stackhouse (Williams) acted as though he hurt his finger, Corsaro asked – he stated he was OK, but has a “sore finger”
- rolloff R25626RT – soil
- 0945-Tom Bass and Mike Dorsey (WVDEP) on site w/someone with a “Triad” hardhat
- spoke w/Fiore
- Tom Bass told Fiore to clean upriver area of slop
- area has no pitch, fly ash is present – Fiore agreed to remove debris from area
- Fiore spoke w/Chris Grose
- Fiore directed Corsaro to photograph the area prior to excavation
- 1140-Fiore and George Jones on bench – Fiore directing GJ (limited view from excavator) to remove material specified by Tom Bass of WVDEP
- 1150-Doug Bowe (Potesta) on site
- 1300-Corsaro back from lunch – Chris Gatens and Jeremy Bandy (WVDEP) on site – Corsaro escorted in – took to work area
- 1320-Fiore and Lafferty back from lunch – Gatens and Bandy signed H&S acknowledgement forms – Fiore and Corsaro escorted them to work area and explained project status

- Gatens wanted to inspect an area of discolored material – Fiore instructed GJ to scoop a bucket of the material
- Gatens stated that the pitch is present in the sample – some black pitch in the sample, some material is brown – Fiore argued that this material is brown – Gatens stated that the brown material is also pitch and that if it is heated it will run
- also, Gatens stated that “if you sample that you’ll find dioxin”
- Fiore placed the material on a shovel and held it in the excavator exhaust and monitored with the FID
- some of the brown material melted, no FID hits
- 1420-Fiore directed Corsaro to begin sampling the slope – Corsaro stated that we would not begin sampling until the excavation was complete – Fiore stated that excavation is complete on part of the slope and that we should go ahead and sample
- 1445-Dan Skaggs on site
- 1455-Dan Skaggs off site
- 1615-Fiore to top of bank to hand-dig small area to show WVDEP that area is excavated to native
- 1630-WVDEP off site
- due to sampling activities today – rolloff tracking and EZ entry not recorded
- 2010- Corsaro and Bowe off site (sampling activities recorded in sampling fieldbook)

9/18/02

- 0745-Corsaro on site
- Fiore and Lafferty already on site
- Corsaro to label rolloffs
- 0810-Williams employees on site
- 0835-Fiore directed Corsaro to take pictures of slope
- Fiore running mini-excavator – laying rip-rap on toe of bank – no geotextile fabric laid yet
- 0920-1000-Corsaro off site w/ Skaggs to look at grease issue
- 1000-Williams back from break
- 1025-Williams (Tim and George) to bench to hand-pick coated C&D debris, excavator placing crusher run at opposite end of bank – workers in boot covers and green gloves
- 1045-Williams out of work area
- 1110-Williams laying geotextile fabric
- 1130-Paul Gebhard (WVDEP) at gate – Skaggs will escort
- 1140-Gebhard on site – Corsaro, Gebhard, John Strickland and Tim Sizemore to location of grease spill
- Corsaro and Gebhard took photos, Strickland and Sizemore removed debris coated with grease and wiped heavy debris with rags. Rags and debris placed in trash bag
- Gebhard approved cleanup – Corsaro and Gebhard took photos – bag of debris labeled and placed at top of bank
- back from lunch – Williams completed geotextile fabric and began covering slope with rip-rap
- 1540-Fiore and Lafferty off site, will be back Tuesday

- Fiore said the activities to be completed in his absence are: rip-rap of bank (not expected to be completed by Tuesday morning); temporary orange fencing around rollofts; leveling top of bank
- 1550-George and Tim placed grease material hand-picked from bank today into rolloff #2 (R2517RT)
- 1645-Williams and Corsaro off site

9/19/02

- 0745-Corsaro on site
- safety meeting – site control and hazards with rip-rap on bank
- 0815-1st load of rip-rap arrived
- 0900-Williams spraying off stumps and GJ taking clean stumps to plant rollofts to go to landfill – one stump has construction debris encased in roots with pitch covering debris – roots have been sprayed, water is on poly and ground – Corsaro instructed Williams to put stump on poly and cover for weekend – Chris Grose approved – also said to put caution tape around rollofts since fence will not be installed until Monday
- 0925-2nd load of rip-rap
- George and John working elsewhere in plant periodically – Tim to be here most of day, GJ to rip-rap bank most of day
- 1045-3rd load of rip-rap
- Tim putting caution tape around rollofts
- rolloff #13 – tailgate open
- 1140-4th load of rip-rap and to lunch
- 1245-back from lunch and 5th load of rip-rap
- 1325-cloud from Great Lakes Chemical – slight odor – alarm went off at Great Lakes – no alarm at Flexsys – GJ and Tim said this happens about 2-3 times a week
- Corsaro spoke w/GJ several times concerning proximity to power line – GJ is also concerned and is aware of hazard – GJ said he believes it is a 110 V line
- 1345-6th load of rip-rap
- 1425-7th load of rip-rap
- 1440-rain
- 1510-8th load of rip-rap
- 1545-9th load of rip-rap
- 1630-covered impacted stump
- 1635-10th load of rip-rap
- 1645-closed rolloff #13
- 1645-Williams off site
- Corsaro locked and secured site
- 1700-Corsaro off site

9/23/02

- 0740-Corsaro on site
- Williams workers are working intermittently in other areas of the plant
- George and John preparing to place fence around rollofts
- 0845-GJ on site – beginning rip-rap of bank

- 0850-Corsaro spoke w/George and John about being careful putting up fence (especially pounding stakes)
- 0900-Corsaro gave GJ radio and went over safety issues w/GJ – watch for people on slope (hazards with rip-rap), unloading of rip-rap (potential hazards with rolling rocks), and power lines
- 1115-bank covered with rip-rap
- 1st load of rip-rap delivered
- 1250-back from lunch – GJ getting picker to remove tool box and drum from stairs
- 1300-removed drum and placed in dump bed
- 1310-placed monitoring stations in dump bed
- 1320-removed drum and placed in dump bed
- began removing rest of clean stumps and cleaning excavator bucket
- washed one of the stumps
- 1500-Corsaro off site (w/Chris Grose's approval) – let GJ know
- Tim informed Corsaro on 9/24/02 that they left the site at 1600

9/24/02

- 0730-Corsaro on site
- Fiore and Williams already on site
- planning to remove boom – Carl Skidmore asked for workers – Fiore said we can remove boom tomorrow

Rolloff Inventory
Solutia Bank Stabilization Project
Potesta Project No. 01-0081-140

Rolloff ID #	Serial #	Date Filled	Activity	Contents (%)		Date Sampled
				Soil	Debris	
TP-S-001	R2517RT	8/29/02	Testpitting	50	50	10/23/02
TP-S-002	R25763RT	8/29/02	Testpitting	50	50	10/23/02
TP-S-003	R2513RT	9/10/02	Slope Repair	90	10	10/23/02
TP-S-004	R25047RT	9/16/02	Slope Repair	30	70	10/23/02
TP-S-005	R25126RT	9/16/02	Slope Repair	30	70	10/23/02
TP-S-006	R25928RT	9/16/02	Slope Repair	90	10	10/23/02
TP-S-007	R25613RT	9/16/02	Slope Repair	90	10	10/23/02
TP-S-008	R2876RT	9/16/02	Slope Repair	80	20	10/23/02
TP-S-009	R25057RT	9/17/02	Slope Repair	100	0	10/23/02
TP-S-010	R25626RT	9/17/02	Slope Repair	60	40	10/23/02
TP-S-011	R28100RT	9/17/02	Slope Repair	50	50	10/23/02
TP-S-012	R2880RT	9/17/02	Slope Repair	50	50	10/23/02
TP-S-013	R25094RT	9/17/02	Slope Repair	50	50	10/23/02
TP-S-014	R2999RT	9/17/02	Slope Repair	80	20	10/23/02

Notes:

Color Coded Labels:

Black=50/50 mix (soil/debris)

Orange=mostly soil

Green=mostly debris

Soil/Debris percentages are approximate - based on estimations during excavation

APPENDIX F

Test Pit Analytical Results

Results of Analytical Data Quality Evaluation

Sample Delivery Group No.: 0208B88

Test Pit Analytical Results

Kanawha River Bank Stabilization Project

This data evaluation was conducted on nine soil samples (0208B88-01A through -09A) which were collected on August 29, 2002 from test pits excavated along the Kanawha River bank outside the fenced plant limits of the Flexsys America L.P. Nitro, West Virginia facility. The parameters associated with this data set were proposed by Solutia, Inc. and presented in the following document submitted to the USEPA-Region III and the West Virginia Division of Environmental Protection-Office of Environmental Remediation, "Kanawha River Bank Stabilization and Residue Cleanup Interim Measures Work Plan".

Laboratory sample analysis was conducted by REI Consultants, Inc. of Beaver, West Virginia, for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) by USEPA SW-846 Methods 8260B and 8270C respectively. N-nitrosodiphenylamine and aniline were added to the 8270C target compound list. Dioxin/furan (USEPA Method 1613B) analysis was subcontracted to Triangle Laboratories, Inc. of Durham, North Carolina. Asbestos analysis was conducted by Engineering and Testing 2000 of Lewisburg, West Virginia, but was not verified in this evaluation.

Volatile Organic Compounds

Potesta & Associates, Inc. following the USEPA guidance, "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", October 1999 completed data validation procedures for the volatile organic compound analysis.

Holding Times

Technical requirements for holding times have not been established for VOCs in soils; therefore, the USEPA's 14 day criterion for water has been applied. All collected soil samples were transferred and analyzed within the prescribed holding time.

GC/MS Instrument Performance Checks

The regular performance check of the GC/MS instrument was completed with bromofluorobenzene. This routine analysis was performed at the beginning of each 12-hour period that samples were analyzed. All of the reported performance check results met the prescribed ion abundance criteria.

Initial Calibration

Compliance requirements have been met for satisfactory initial calibration of the instrument utilized to analyze the project samples with regard to relative response factors, percent relative standard deviation, calibration curve linearity, and standard concentrations.

Continuing Calibration

Acrolein and styrene have RRFs below the acceptance criterion of 0.05 in each of the two continuing calibrations associated with this sample delivery group. Acrolein is of no

consequence since it is not on the target compound list, but styrene results, which are reported as non-detect for each sample, must be qualified as "R". All other acceptance criteria have been met.

Blanks

Acetone appears in each of the two method blanks associated with this sample delivery group. Positive results for acetone in samples 0208B88-02, 04, -05, -07, and -08 are all less than 10X the concentration found in the corresponding method blank, and therefore, are qualified "U".

System Monitoring Compounds

Three system monitoring compounds (dibromofluoromethane, toluene-d8, and p-bromofluorobenzene) were added to all samples and blanks. Recoveries for these compounds in the samples and blank were within the limits of acceptance criteria.

Matrix Spikes/Matrix Spike Duplicates

All acceptance criteria have been met for the matrix spikes and matrix spike duplicate indicating satisfactory precision, accuracy, and overall instrument performance.

Internal Standards

Internal standard area counts for fluorobenzene, chlorobenzene-d5, and 1,4-dichlorobenzene-d4 in sample 0208B88-02 are below acceptance criteria. All non-detect results are qualified "UJ", and positive results for benzene, ethylbenzene, toluene, vinyl chloride, and m,p-xylene are "J" qualified. Positive results for o-xylene and isopropylbenzene were obtained via diluted runs in which the internal standards were within acceptance criteria, hence qualification is not necessary. Acetone has been qualified "U" as previously discussed.

Internal standard area counts for fluorobenzene and chlorobenzene-d5 in sample 0208B88-05 are below acceptance criteria. All non-detect results of compounds eluting before and including bromobenzene are qualified "UJ", and positive results for compounds eluting before isopropylbenzene except for vinyl chloride are "J" qualified. Isopropylbenzene and vinyl chloride were analyzed by diluted runs in which the internal standards met acceptance criteria, and require no qualification.

No other internal standard issues are noted requiring data qualification.

Target Compound Identification

Identification of target compounds is complicated by the fact that the mass spectra reports provided by the laboratory are of poor quality and are virtually unreadable. Most positive results have been validated as unqualified based on retention times and q-values (a statistical analysis of the compound spectral match between the sample and standard – i.e. a q-value of 95 indicates a 95% probability of correct compound identification) from the raw data with the following exceptions: 1,2,4-trimethylbenzene in 0208B88-03 is outside the acceptable retention time window qualified as "U"; acetone in 0208B88-02 has a q-value of 33 and an unreadable mass spectrum qualified as "R"; acetone in 0208B88-05 has a q-value of 70 and no mass spectrum qualified as "R"; and acetone in 0208B88-07 has a q-value of 47 and an unreadable mass spectrum qualified as "R".

Compound Quantitation and Reported CRQLs

Acceptance criteria have been met.

Tentatively Identified Compounds

Tentatively identified compounds have not been evaluated or reported.

System Performance

There appears to be a slightly elevated baseline with background "noise" at the beginning and end of the chromatograms for the blanks analyzed at the beginning of each 12-hour analytical period. This condition appears to have not changed over the periods of analysis, and does not significantly affect the quality of the data.

Overall Assessment

Qualified data is summarized as follows:

All non-detect results for styrene are qualified "R"

Positive results for acetone - samples 0208B88-02a, -05A, and -07A are qualified "R"
- samples 0208B88-04A and -08A are qualified "U"

Sample 0208B88-02A - non-detect results are qualified "UJ"
- positive results for benzene, ethylbenzene, toluene, vinyl chloride, and m,p-xylene are qualified "J"

Sample 0208B88-03A - positive result for 1,2,4-trimethylbenzene is qualified "U"

Sample 0208B88-05A - non-detect for the following results are qualified "UJ"

dichlorodifluoromethane	2,2-dichloropropane	dibromochloromethane
chloromethane	2-hexanone	1,2-dibromoethane
vinyl chloride	cis-1,2-dichloroethene	chlorobenzene
bromomethane	chloroform	1,1,1,2-tetrachloroethane
chloroethane	bromochloromethane	ethylbenzene
trichlorofluoromethane	1,1,1-trichloroethane	o-xylene
acetone	1,1-dichloropropene	styrene
bromobenzene	carbon tetrachloride	isopropylbenzene
1,3,5-trimethylbenzene	benzene	bromoform
1,1-dichloroethene	1,2-dichloroethane	1,1,2,2-tetrachloroethane
vinyl acetate	trichloroethene	1,2,3-trichloropropane
m,p-xylene	1,2-dichloropropane	n-propylbenzene
methylene chloride	bromodichloromethane	carbon disulfide
toluene	MTBE	1,1-dichloroethane
trans-1,2-dichloroethane	2-butanone	dibromomethane
4-methyl-2-pentanone	dibromomethane	1,1,2-trichloro-1,2,2-trifluoroethane
trans-1,3-dichloropropene	1,1,2-trichloroethane	
1,3-dichloropropane	tetrachloroethene	

Sample 0208B88-05A - positive result for benzene is qualified "J".

Elevated quantitation levels are the result of matrix issues.

Samples were not analyzed for methyl acetate, cyclohexane, or methyl cyclohexane.

Semivolatile Organic Compounds

Potesta & Associates, Inc. following the USEPA guidance, "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", October 1999 completed data validation procedures for the volatile organic compound analysis.

Holding Times

Technical requirements for sample holding times have not been established for SVOCs in soil matrices, but it has been recommended that semivolatile compounds in soil matrices be extracted within 14 days of sample collection and analyzed within 40 days of extraction. Samples included in this sample delivery group have met these criteria.

GC/MS Instrument Performance Check

The analysis of the instrument performance check with decafluorotriphenylphosphine was performed at the beginning of each 12-hour period that samples were analyzed, and met the required ion abundance criteria.

Initial Calibration

The percent RSD values for 2,4-dinitrophenol (36.21) and 3,3'-dichlorobenzidine (49.55) are outside the 30 percent acceptance criterion, but the RRF values 0.111 and 0.317 respectively meet the > 0.05 criterion. Results for these compounds in all samples are negative and require no qualification. No other issues with the initial calibration have been found.

Continuing calibration

The laboratory did not include a Form VII Continuing Calibration Check, which proved inconvenient when checking RRFs since the included Continuing Calibration Report does not report RRFs. Manual RRF calculations were performed on selected "poor performers" with no values found below the acceptable limit of 0.05. Other criteria for percent difference and frequency have been satisfied.

Blanks

Method blanks were analyzed at the required frequency and reported to be free of contaminants.

Surrogate Spikes

Six system monitoring compounds, three acid compounds (2-fluorophenol, phenol-d5, 2,4,6-tribromophenol) and three base/neutral compounds (nitrobenzene-d5, 2-fluorobiphenyl, terphenyl-d14), were added to all samples and blanks. No sample had more than one monitoring compound out of specification per fraction, thus requiring no action. Monitoring compound recoveries for blanks are all within limits.

Matrix Spikes/Matrix Spike Duplicates

The batch matrix spike percent recoveries for 1,4-dichlorobenzene and 1,2,4-trichlorobenzene, and matrix spike duplicate percent recoveries for acenaphthene, 1,4-dichlorobenzene, and 1,2,4-trichlorobenzene are outside percent recovery control limits. However, recoveries for these compounds are within limits for continuing calibrations and laboratory control spikes. It appears as though this is an isolated problem involving the matrix of the spiked sample, thus no action is required.

Internal Standards

The internal standard area count of perylene-d12 for sample 0208B88-09 is below the acceptable limit, requiring a "UJ" qualification for non-detect results of benzo [b] fluoranthene and later eluting compounds. Internal standard retention times and area counts for all other samples of this sample delivery group are within specifications.

Target Compound Identification

No target compounds have been identified in any of the samples within this sample delivery group.

Compound Quantitation and CRQLs

Reported quantitation limits have been properly calculated and reported.

Tentatively Identified Compounds

Tentatively identified compounds have not been evaluated or reported.

System Performance

System performance throughout the analytical period appears satisfactory based on system monitoring spike recoveries, internal standard retention times, and subsequent blanks and continuing calibration verifications. The baselines for sample analyses are markedly elevated over the latter half of the chromatograms. The samples themselves show elevated base lines throughout the latter portion of the chromatograms, but this is likely due to matrix effects.

Overall Assessment

The overall quality of the data for the semivolatile fraction of this sample delivery group is satisfactory. Positive results for benzo [b] fluoranthene, benzo [k] fluoranthene, benzo [a] pyrene, indeno [1,2,3,cd]pyrene, dibenzo(a,h)anthracene, and benzo[g,h,i]perylene in Sample 0208B88-09A are qualified "UJ".

The samples were not tested for atrazine, benzaldehyde, caprolactam, 2,2'-oxybis(1-chloropropane), or 1,1'-biphenyl.
Elevated quantitation levels are the result of matrix issues.

Dioxins/Furans Analysis

For evaluation of data for this project, Potesta & Associates, Inc. utilized the "USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review", EPA-540-R-02-003, August 2002.

Holding Times

Criteria for holding times and storage for all samples have been met.

Mass Calibration and Mass Spectrometer Resolution

Verification has been provided that the instruments involved in these analyses have met resolution requirements of $\geq 10,000$ for perfluorokerosene at the beginning of each 12-hour analytical period.

Window Defining Mix

A window defining mix has been analyzed during the 12-hour analytical period on the instrument set up with a DB-5 column demonstrating appropriate switching times for selected ion monitoring time descriptors.

Chromatographic Resolution

Satisfactory chromatographic resolution has been demonstrated on each instrument by the analysis of a column performance solution during each 12-hour analytical period. The instrument set up with a DB-5 column has demonstrated peak separations between the 2,3,7,8-TCDD and 1,2,3,8-TCDD peaks with a valley less than 25 percent of the peak height of 2,3,7,8-TCDD. The instrument outfitted with a DB-225 column has demonstrated peak separations between 2,3,7,8-TCDF and 2,3,4,7-TCDF with a valley less than 25 percent of the peak height of 2,3,7,8-TCDF.

Instrument Stability

Raw data from the midpoint (C3) standards analyzed at the beginning of each 12-hour analytical period were evaluated with regard to retention times, relative retention times, ion abundance ratios, signal-to-noise ratios, and response. No issues were found which would warrant the qualification of any sample data within this project.

Initial Calibration

The initial calibration of each instrument associated with sample analysis for this project meet criteria set forth by the USEPA regarding resolution, ion abundance, retention time, sensitivity, linearity, concentration, and frequency.

Calibration Verification

Calibration verification was performed at the beginning of each 12-hour analytical period by the analysis of a midpoint (C3) standard on each instrument involved with sample analysis according to the following criteria: ion abundance ratio, retention time, relative retention time, signal-to-noise ratio, and analyte response.

Identification Criteria

Examination of quantitation summaries and corresponding raw data with regard to compound identification criteria including retention times, signal/noise ratios, and ion abundance ratios indicates that the target analytes have been properly identified.

Method Blanks

The method blanks analyzed with this extraction batch meet all QC criteria, and require no data qualification.

Laboratory Control Samples

Laboratory control samples (ongoing precision and recovery sample) meet all acceptance criteria.

Toxicity Equivalency Factor

Toxicity equivalency concentration calculations have been performed correctly.

Dilutions

Samples 0208B88-04A and -09A report results of 1000 and 2570 respectively for 2,3,7,8-TCDD, both of which exceed the calibration range. Dilutions were not performed on these samples, therefore these results are qualified "J".

Second Column Confirmation

Sample 0208B88-09A tested positive for 2,3,7,8-TCDF (24.3pg/g), but due to matrix interference, could not be successfully analyzed on a DB-225 column. This data requires "R" qualification.

Estimated Detection Limit

EDLs have been properly calculated and reported.

Labeled Compound Recoveries

Recoveries for 13C12-1,2,3,4,6,7,8-HpCDD and 13C12-OCDD in samples 0208B88-02A, -05A, and -06A, exceed QC limits do to matrix interference. Data for the compounds 1,2,3,4,6,7,8-HpCDD and OCDD in these samples are qualified "J". Several samples exhibit ion abundance ratios and S/N ratios which are outside QC limits, however, this does not require qualification.

Overall Assessment

The positive result for 1,2,3,7,8-PeCDF (63.8) in 0208B88-04A is "J" qualified because of interference of diphenyl ether.

Qualified data is summarized as follows:

0208B88-02A - 1,2,3,4,6,7,8-HpCDD and OCDD are "J" qualified

0208B88-04A - 1,2,3,7,8-PeCDF, and 2,3,7,8-TCDD are "J" qualified

0208B88-05A - 1,2,3,4,6,7,8-HpCDD and OCDD are "J" qualified

0208B88-06A - 1,2,3,4,6,7,8-HpCDD and OCDD are "J" qualified

0208B88-09A - 2,3,7,8-TCDD is "J" qualified; 2,3,7,8-TCDF is qualified "R"

Elevated quantitation levels are the result of matrix issues.

Confirmation Sample Analytical Results

Results of Analytical Data Quality Evaluation

Sample Delivery Group No.: 0209606
Confirmation Sample Analytical Results
Kanawha River Bank Stabilization Project

This data evaluation was conducted on 10 soil samples (0209606-01A through -10A) including one sample (0209606-01A) analyzed as a matrix spike/matrix spike duplicate, and one trip blank. Soil samples were collected on September 17, 2002, from an area along the Kanawha River bank outside the fenced plant limits of the Flexsys America L.P. Nitro, West Virginia facility; the same area from which the roll-off soil was excavated. After removal procedures were completed and the underlying native soil was exposed, the samples were collected as described in "Kanawha River Bank Stabilization and Residue Cleanup Interim Measures Work Plan", which was proposed by Solutia, Inc. and submitted to the USEPA-Region III and the West Virginia Division of Environmental Protection-Office of Environmental Remediation.

Sample analysis was conducted by REI Consultants, Inc. of Beaver, West Virginia for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) by USEPA SW-846 Methods 8260B and 8270C respectively. N-nitrosodiphenylamine and aniline were added to the 8270C target analyte list. Dioxin/furan (USEPA Method 1613B) analysis was subcontracted to Triangle Laboratories, Inc. of Durham, North Carolina. Asbestos analysis was subcontracted to Engineering and Testing 2000 of Lewisburg, West Virginia, but was not verified in this evaluation.

Volatile Organic Compounds

Potesta & Associates, Inc. following the USEPA guidance, "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", October 1999 completed data validation procedures for the volatile organic compound analysis.

Holding Times

Technical requirements for holding times have not been established for VOCs soils; therefore, the USEPA's 14 day criterion for water has been applied. All soil samples were transferred and analyzed within the prescribed holding time.

GC/MS Instrument Performance Checks

The regular performance check of the GC/MS instrument was completed with bromofluorobenzene. This routine analysis was performed at the beginning of each 12-hour period that samples were analyzed. All of the reported performance check results met the prescribed ion abundance criteria.

Initial Calibration

The RRF for styrene (0.02537) in the soil initial calibration (ICAL) is below the level of acceptance of 0.05 requiring that results for styrene in the soil samples, all of which are negative, be qualified as "R". All other acceptance criteria for the soil ICAL have been met.

The RRFs for acetone (0.03427) and 2-butanone (0.03555) in the water ICAL are below the level of acceptance of 0.05, however no action is required since the only associated sample (0209606-11A) is the trip blank which requires no qualification.

Continuing Calibration

The continuing calibrations (SEP3010.d and SEP3026.d) associated with the soil sample analyses both exhibit RRFs for styrene which are below the acceptable limit. All results for styrene are negative and are qualified "R".

Blanks

Method blanks were analyzed at the required frequency and are free of contaminants, but the chromatography exhibits much interference. The trip blank is free of contamination.

System Monitoring Compounds

Four system monitoring compounds (SMC) were added to all samples and blanks including three required compounds (1,2-dichloroethane-d4, toluene-d8, and p-bromofluorobenzene), and one additional compound (dibromofluoromethane). Samples 0209606-01A, -06A, -07A, and -10A have SMC recoveries above the upper QC limit which qualifies detected analytes as "J" with no qualification for non-detects. Samples 0209606-08A and -09A have SMC recoveries less than the lower QC limit but above 10 percent qualifying detected analytes as "J" and non-detects as "UJ".

Matrix Spike/Matrix Spike Duplicate

The Matrix Spike/Matrix Spike Duplicate has two of five relative percent difference values, and 5 of 10 spike recoveries outside QC limits.

Regional Quality Assurance and Quality Control

The following table compares the replicate samples 0209606-01A and -10A.

	0209606-01A(ppb)	0209606-10A(ppb)	% Difference
acetone	24.9	25.7	2
benzene	2.1	3.1	24
trichloroethene	2.9	3.6	22
toluene	ND	2.2	3

Internal Standards

The internal standards fluorobenzene and chlorobenzene-d5 in sample 0209606-08a, exhibit area counts which are 16 percent and 28 percent of their respective 12-hour standards. This is significantly less than the minimum QC limit of 50 percent. Compounds associated with these internal standards, all of which are non-detect, are qualified "R". Also, method blank SEP3029.d reports an area count for fluorobenzene which is 47 percent of the 12-hour standard.

Target Compound Identification

Target compound identification is based upon retention times, q-values (a statistical analysis of the compound spectral match between the sample and calibration standard – i.e. a q-value of 95 indicates a 95 percent probability of correct compound identification), library quality match values, and what little information could be gleaned from poor copies of the mass spectra. No data is being qualified based on these criteria.

Compound Quantitation and Reported CRQLs

Quantitation calculations have been performed in accordance with method specifications.

Tentatively Identified Compounds

Tentatively identified compounds have not been evaluated or reported.

System Performance

Based on issues previously discussed, performance of the GC/mass spectrometer utilized for these analyses is judged to be less than satisfactory. The laboratory claims that matrix interference is the cause for some of these issues, but upon examination of method blank chromatography, this does not seem to be the case. It appears as though this instrument has some problems- i.e. air leaks, column degradation, "dirty" source etc., which may have adversely affected the data.

Overall Assessment

Qualified data is summarized as follows:

All styrene data is qualified "R" (all non-detect).

The following compounds in sample 0209606-08A are qualified "R".

dichlorodifluoromethane	2,2-dichloropropane	tetrachloroethene
chloromethane	2-hexanone	dibromochloromethane
vinyl chloride	cis-1,2-dichloroethene	1,2-dibromoethane
bromomethane	chloroform	chlorobenzene
chloroethane	bromochloromethane	1,1,1,2-tetrachloroethane
trichlorofluoromethane	1,1,1-trichloroethane	ethylbenzene
acetone	1,1-dichloropropene	o-xylene
acrolein	carbon tetrachloride	styrene
acrylonitrile	benzene	isopropylbenzene
1,1-dichloroethene	1,2-dichloroethane	bromoform
vinyl acetate	trichloroethene	1,1,2,2-tetrachloroethane
iodomethane	1,2-dichloropropane	1,2,3-trichloropropane
methylene chloride	bromodichloromethane	n-propylbenzene
carbon disulfide	dibromomethane	bromobenzene
trans-1,2-dichloroethane	cis-1,3-dichloropropene	1,3,5-trimethylbenzene
2-butanone	trans-1,3-dichloropropene	1,1,2-trichloro-1,2,2-trifluoroethane
1,1-dichloroethane	1,1,2-trichloroethane	MTBE
4-methyl-2-pentanone	1,3-dichloropropane	

All other data are qualified "J" for positive results and "UJ" for non-detects.

Samples were not analyzed for methyl acetate, cyclohexane, or methyl cyclohexane.

Elevated quantitation levels are the result of matrix issues.

Semivolatile Organic Compounds

Potesta & Associates, Inc. following the USEPA guidance, **"USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review"**, October 1999 completed data validation procedures for the volatile organic compound analysis.

Holding Times

Technical requirements for sample holding times have not been established for SVOCs soil matrices, but it has been recommended that semivolatile compounds in soil matrices be extracted within 14 days of sample collection and analyzed within 40 days of extraction. Samples included in this sample delivery group have met these criteria.

GC/MS Instrument Performance Check

The analysis of the instrument performance check with decafluorotriphenylphosphine was performed at the beginning of each 12-hour period that samples were analyzed, and met the required ion abundance criteria.

Initial Calibration

Criteria for satisfactory initial calibration of the instrument associated with sample analysis were been met pertaining to relative response factors, percent relative standard deviation, calibration curve linearity, and standard concentrations.

Continuing Calibration

The laboratory did not include a Form VII Continuing Calibration Check, which proved inconvenient when checking RRFs since the included Continuing Calibration Report does not report RRFs. Manual RRF calculations were performed on compounds with high percent D values and low area percent values with no values found below the acceptable limit of 0.05. Other criteria for percent difference and frequency have been satisfied.

Blanks

Method blanks were analyzed at the required frequency and reported to be free of contaminants.

Surrogate Spikes

Six system monitoring compounds, three acid compounds (2-fluorophenol, phenol-d5, 2,4,6-tribromophenol) and three base/neutral compounds (nitrobenzene-d5, 2-fluorobiphenyl, terphenyl-d14), were added to all samples and blanks. All surrogate spikes are within required QC limits.

Matrix Spikes/Matrix Spike Duplicates

Spike recovery limits for 8 of 22 spikes in the matrix spike/matrix spike duplicate are outside acceptance limits. Percent differences, however, are all within acceptable limits. The associated laboratory control sample spikes are all within limits, thus showing that the instrument is in control. This issue appears isolated and can likely be attributed to matrix interferences, therefore no action is taken.

Regional Quality Assurance and Quality Control

The following table compares the replicate samples 0209606-01A and -10A.

	0209606-01A(ppm)	0209606-10A(ppm)	% Difference
n-nitrosodiphenylamine	65.2	14.8	126

Due to the large difference in results, positive results for n-nitrosodiphenylamine will be qualified "J".

Internal Standards

Internal standard performance for each analysis was within the quality control limits set for each internal standard peak area as well as the retention time when compared to the 12-hour calibration standard.

Target Compound Identification

The only positive results reported for the entire sample delivery group are for n-nitrosodiphenylamine in samples 0209606-01A, -02A, -07A and -10A. The laboratory did not include mass spectra in the raw data, so identification verification has been based upon retention times and q-values. Retention times in each sample matches the retention time for n-nitrosodiphenylamine in the associated continuing calibration, and q-values are above 90. No data qualification is needed based on target compound identification.

Compound Quantitation and Reported CRQLs

Quantitation calculations have been performed in accordance with method specifications.

Tentatively Identified Compounds

Tentatively identified compounds have not been evaluated or reported.

System Performance

The analytical system appears to have performed well throughout the analytical period based on QC items previously discussed. The samples themselves show elevated base lines throughout the latter portion of the chromatograms, but this is likely due to matrix effects.

Overall Assessment

The overall quality of the data for the semivolatile fraction of this sample delivery group is satisfactory. Positive results for n-nitrosodiphenylamine for samples 0209606-01A, -02A, -07A and -10A are qualified "J".

The samples were not tested for atrazine, benzaldehyde, caprolactam, 2,2'-oxybis(1-chloropropane), or 1,1'-biphenyl.

Elevated quantitation levels are the result of matrix issues.

Dioxins/Furans Analysis

For evaluation of data for this project, Potesta & Associates, Inc. utilized the **"USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review"**, EPA-540-R-02-003, August 2002.

Holding Times

Criteria for holding times and storage for all samples have been met.

Field Duplicates

The following table compares the replicate samples 0209606-01A and -10A.

	0209606-01A(pg/g)	0209606-10A(pg/g)	% Difference
2378-TCDD	3940	3640	8
12378-PeCDD	506	535	14
123478-HxCDD	115	116	1
123678-HxCDD	207	205	1
123789-HxCDD	91.8	111	19
1234678-HpCDD	729	1020	33
OCDD	5850	4760	21
2378TCDF	219	277	23
12378-PeCDF	ND	ND	
23478-PeCDF	104	111	6
123478-HxCDF	188	278	39
123678-HxCDF	57.5	86.6	40
234678-HxCDF	ND (14.8)	136	80
123789-HxCDF	ND	ND	
1234678-HpCDF	340	500	38
1234789-HpCDF	79.4	88.9	6
OCDF	973	705	32

Mass Calibration and Mass Spectrometer Resolution

Verification has been provided that each instrument involved in these analyses has met resolution requirements of $\geq 10,000$ units for perfluorokerosene at the beginning of each 12-hour analytical period.

Window Defining Mix

A window defining mix has been analyzed during each 12-hour analytical period on instruments set up with DB-5 columns demonstrating appropriate switching times for selected ion monitoring time descriptors.

Chromatographic Resolution

Satisfactory chromatographic resolution has been demonstrated on each instrument by the analysis of a column performance solution during each 12-hour analytical period. Instruments set up with DB-5 columns have demonstrated peak separations between the 2,3,7,8-TCDD and 1,2,3,8-TCDD peaks with a valley less than 25 percent of the peak height of 2,3,7,8-TCDD. Instruments outfitted with DB-225 columns have demonstrated peak separations between 2,3,7,8-TCDF and 2,3,4,7-TCDF with a valley less than 25 percent of the peak height of 2,3,7,8-TCDF.

Instrument Stability

Raw data from the midpoint (C3) standards analyzed at the beginning of each 12-hour analytical period were evaluated with regard to retention times, relative retention times, ion abundance ratios, signal-to-noise ratios, and response. No issues were found which would warrant the qualification of any sample data within this project.

Initial Calibration

The initial calibration of each instrument associated with sample analysis for this project met criteria set forth by the USEPA regarding resolution, ion abundance, retention time, sensitivity, linearity, concentration, and frequency.

Calibration Verification

Calibration verification was performed at the beginning of each 12-hour analytical period by the analysis of a midpoint (C3) standard on each instrument involved with sample analysis according to the following criteria: ion abundance ratio, retention time, relative retention time, signal-to-noise ratio, and analyte response.

Identification Criteria

Examination of quantitation summaries and corresponding raw data with regard to compound identification criteria including retention times, signal/noise ratios, and ion abundance ratios indicates that target analytes have been properly identified.

Method Blanks

The method blank analyzed with this extraction batch meets all QC criteria, and requires no data qualification.

Laboratory Control Samples

Laboratory control samples (ongoing precision and recovery sample) meet all acceptance criteria.

Toxicity Equivalency Factor

Toxicity equivalency concentration calculations have been performed correctly.

Dilutions

Samples 0209606-01A, -04A, -06A, -07A, -08A, and -10A report positive results for 2,3,7,8-TCDD, all of which exceed the calibration range. Sample 0209606-01A and -10A also reports OCDD exceeded the calibration range. Dilutions were not run for these samples which require that these data be qualified "J".

Second Column Confirmation

Second Column Confirmation was performed in order to confirm all positive results for 2,3,7,8-TCDF.

Estimated Detection Limit

EDLs have been properly calculated and reported.

Labeled Compound Recoveries

¹³C12-2,3,4,6,7,8-HxCDF has recoveries below QC limits in samples 0209606-07A and -10A. Therefore, 2,3,4,6,7,8-HxCDF results for these samples are qualified "J". Several samples exhibit ion abundance ratios and S/N ratios which are outside QC limits, however, this does not require qualification. These issues are all the result of matrix interference.

Overall Assessment

Qualified data summarized as follows:

Results for 2,3,7,8-TCDD in samples 0209606-01A, -04A, -06A, -07A, -08A, and -10A are "J" qualified.

Results for OCDD in samples 0209606-01A and -10A are "J" qualified.

Results for 2,3,4,6,7,8-HxCDF in samples 0209606-07A and -10A are "J" qualified.

Elevated quantitation levels are the result of matrix issues.

Roll-off Sample Analytical Results

Results of Analytical Data Quality Evaluation

Sample Delivery Group No.: 0210864

Roll-off Sample Analytical Results

Kanawha River Bank Stabilization Project

This data evaluation was conducted on 16 soil samples (0210864-01A through -16A) including one sample (0210864-16A) analyzed as matrix spike/matrix spike duplicate, as well as two trip blanks (0210864-18A and -19A) and one equipment decontamination rinsate (EDR) blank (0210864-17A). Soil samples were collected on October 23, 2002 from roll-off containers containing materials excavated from the surface of the Kanawha River bank outside the fenced limits of the Flexsys America L.P. Nitro, West Virginia facility. The parameters associated with this data set were proposed by Solutia, Inc. and presented in the following document submitted to the USEPA-Region III and the West Virginia Division of Environmental Protection-Office of Environmental Remediation, "Kanawha River Bank Stabilization and Residue Cleanup Interim Measures Work Plan".

Laboratory sample analysis was conducted by REI Consultants, Inc. of Beaver, West Virginia for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) by USEPA SW-846 Methods 8260B and 8270C respectively. N-nitrosodiphenylamine and aniline were added to the target compound list. Dioxin/furan (USEPA Method 1613B) analysis was subcontracted to Triangle Laboratories, Inc. of Durham, North Carolina. Asbestos analysis was subcontracted to Engineering and Testing 2000 of Lewisburg, West Virginia, but was not verified in this evaluation.

Volatile Organic Compounds

Potesta & Associates, Inc. following the USEPA guidance, "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", October 1999 completed data validation procedures for the volatile organic compound analysis.

Holding Times

Technical requirements for holding times have not been established for VOCs soils; therefore, the USEPA's 14 day criterion for water has been applied. All collected soil samples were transferred and analyzed within the prescribed holding time.

GC/MS Instrument Performance Checks

The regular performance check of the GC/MS instrument was completed with bromofluorobenzene. This routine analysis was performed at the beginning of each 12-hour period that samples were analyzed. All of the reported performance check results met the prescribed ion abundance criteria.

Initial Calibration

The RRF for styrene (0.01790) in the soil initial calibration (ICAL) is below the level of acceptance of 0.05 requiring that results for styrene in the soil samples, all of which are negative, be qualified as "R". All other acceptance criteria for the soil ICAL have been met.

The RRF for acetone (0.03194) in the water ICAL is below the level of acceptance of 0.05, however no action is required since the only associated samples (samples 0210864-17A, -18A, and -19A) are trip blanks and the EDR blank, neither of which require qualification.

Continuing Calibration

The continuing calibration (NOV0422.d) associated with soil samples 0210864-11A through -16A reports an RRF for styrene of 0.018 which is below the accepted value of 0.05. Each of these samples, which are non-detect for styrene, require an "R" qualifier (-16A is the ms/msd and requires no qualification). The continuing calibration (OCT2941.d) associated with the water matrix samples reports RRFs of 0.041 and 0.032 respectively for 2-butanone and acetone. The only analyses associated with this continuing calibration are the trip blanks and the EDR sample which need not be qualified. The continuing calibration (OCT3102.d) analyzed for the analytical batch containing the ms/msd associated with the trip blanks and EDR blank reports RRFs of 0.041 and 0.032 for 2-butanone and acetone respectively. Again, the trip blanks and EDR require no qualification.

Blanks

Method blanks were analyzed at the required frequency and reported to be free of contaminants. Two trip blanks were analyzed for this sample delivery group and reported to be free of contaminants. The equipment decontamination rinsate blank were also free of contamination. It has been previously noted in the continuing calibration section that the RRFs for 2-butanone and acetone were below acceptance criteria for the trip blanks and EDR. This would indicate that the non-detect data for these compounds would be unusable, but since only four samples tested positive for acetone and none tested positive for 2-butanone, contamination by these compounds during transportation or decontamination procedures does not seem likely. With this in mind, no action was taken.

System Monitoring Compounds

Four system monitoring compounds were added to all samples and blanks including three required compounds (1,2-dichloroethane-d4, toluene-d8, and p-bromofluorobenzene), and one additional compound (dibromofluoromethane). Samples 0210864-02A, -03A, 06A, 09A, 10A, and -15A have recoveries for system monitoring compounds which exceed acceptance criteria. Non-detect results in these samples require no qualification. The following positive results require "J" qualification: acetone (-03A, -09A, and -10A), benzene (-02A, -03A, -06A, -09A, -10A, and -15A), carbon disulfide (-10A and -15A), trichloroethene (-02A, -09A, -10A, and -15A), toluene (-09A and -15A), and 1,2-dibromo-3-chloropropane (-09A). No samples have recoveries below acceptance criteria.

Matrix Spikes/Matrix Spike Duplicates

All acceptance criteria have been met for the matrix spikes and matrix spike duplicates indicating satisfactory precision, accuracy, and overall instrument performance.

Regional Quality Assurance and Quality Control

Samples 0210864-14A and 0210864-15A are field duplicates. Field duplicates of soil samples are not usually analyzed for VOC analysis since soil for such samples typically is homogenized or composted resulting in the loss of VOCs to vaporization. The soil for these duplicates was not homogenized, but instead are separate samples which were co-located as described in the work plan.

	-14A (ppb)	-15A (ppb)	% Difference
acetone	13.0	ND	18
benzene	10.3	12.9	22
carbon disulfide	ND	11.5	14
trichloroethene	5.6	9.3	31
toluene	ND	2.4	6

Internal Standards

The internal standard area counts for 1,4-dichlorobenzene-d4 in samples 0210864-04A, -05A, -06A, -07A, -09A, and -10A are below the acceptance criterion of -50 percent. The only positive result quantitated by 1,4-dichlorobenzene-d4, 1,2-dibromo-3-chloropropane in 0210864-09A, is qualified "J"; all other results are non-detect and are qualified "UJ". Affected compounds include:

2-chlorotoluene	4-chlorotoluene	tert-butylbenzene
1,2,4-trimethylbenzene	Sec-butylbenzene	p-isopropyltoluene
1,3-dichlorobenzene	1,4-dichlorobenzene	n-butylbenzene
1,2-dichlorobenzene	1,2,3-trichlorobenzene	1,2,4-trichlorobenzene
Hexachlorobutadiene	1,2-dibromo-3-chloropropane	

Target Compound Identification

Identification of target compounds is complicated by the fact that the mass spectra reports provided by the laboratory are of poor quality and are virtually unreadable due to poor copy quality. Most positive results have been validated as unqualified based on retention times and q-values (a statistical analysis of the compound spectral match between the sample and calibration standard – i.e. a q-value of 95 indicates a 95 percent probability of correct compound identification) from the raw data. The exceptions being the reported positive results for acetone in the samples 0210864-03a, -09A, -10A, and -14A. This data failed the retention time criterion of ± 0.06 RRT units of the standard RRT and is qualified "U".

Compound Quantitation and Reported CRQLs

Quantitation calculations have been performed in accordance with method specifications.

Tentatively Identified Compounds

Tentatively identified compounds have not been evaluated or reported.

System Performance

There appears to be a slight elevation in the baseline with background "noise" at the beginning and end of the chromatograms throughout the analyses. This condition is also visible in the blanks and continuing calibration checks, and appears to have not changed over the periods of analysis. The system appears to be in control based on analysis of continuing calibrations, laboratory control samples, and matrix spikes/matrix spike duplicates.

Overall Assessment

Qualified data is summarized as follows:

Negative results for styrene in all samples are qualified "R".

Positive results for carbon disulfide in samples 0210864-10A and -15A are "J" qualified.

Positive results for benzene in samples 0210864-02A, -03A, -06A, -09A, -10A, and -15A are "J" qualified.

Positive results for trichloroethene in the samples 0210864-02A, -09A, -10A, and -15A are "J" qualified.

Positive results for toluene in the samples 0210864-09A and -15A are "J" qualified

Positive results for 1,2-dibromo-3-chloropropane in sample 0210864-09A are "J" qualified.

Negative results for the following compounds in samples 0210864-04A, -05A, -06A, -07A, -09A, and -10A are qualified "UJ".

2-chlorotoluene
1,2,4,-trimethylbenzene
1,3-dichlorobenzene
1,2-dichlorobenzene
Hexachlorobutadiene

4-chlorotoluene
Sec-butylbenzene
1,4-dichlorobenzene
1,2,3-trichlorobenzene
1,2-dibromo-3-chloropropane

tert-butylbenzene
p-isopropyltoluene
n-butylbenzene
1,2,4-trichlorobenzene

Positive results for acetone in the samples 0210864-03a, -09A, -10A, and -14A are qualified "U".

Samples were not analyzed for methyl acetate, cyclohexane, or methyl cyclohexane.

Elevated quantitation levels are the result of matrix issues.

Semivolatile Organic Compounds

Potesta & Associates, Inc. following the USEPA guidance, **"USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review"**, October 1999 completed data validation procedures for the volatile organic compound analysis.

Holding Times

The equipment decontamination rinsate blank exceeded the preparatory hold time limit by one day. Data from this analysis requires no qualification, and it is further determined that this issue will not significantly affect the overall quality of the data for this sample delivery group. Holding time requirements for all other samples have been met.

GC/MS Instrument Performance Check

The analysis of the instrument performance check with decafluorotriphenylphosphine was performed at the beginning of each 12-hour period that samples were analyzed, and met the required ion abundance criteria.

Initial Calibration

The percent RSD value for 2,4-dinitrophenol (38.95) is outside the 30 percent acceptance criterion, but the RRF value of 0.182 meets the > 0.05 criterion. Results for 2,4-dinitrophenol in all samples are negative and require no qualification. No other issues with the initial calibration have been found.

Continuing calibration

The laboratory did not include a Form VII Continuing Calibration Check, which proved inconvenient when checking RRFs since the included Continuing Calibration Report does not report RRFs. Manual RRF calculations were performed on selected "poor performers" with no values found below the acceptable limit of 0.05. Other criteria for percent difference and frequency have been satisfied.

Blanks

Method blanks were analyzed at the required frequency and reported to be free of contaminants. The equipment decontamination rinsate blank is also free of contamination.

Surrogate Spikes

Six system monitoring compounds, three acid compounds (2-fluorophenol, phenol-d5, 2,4,6-tribromophenol) and three base/neutral compounds (nitrobenzene-d5, 2-fluorobiphenyl, terphenyl-d14), were added to all samples and blanks. Samples 0210864-01A, -02A, -11A, and -13A each have two base fraction surrogates exceeding the upper acceptance limits, and sample 0210864-11A also has two acid fraction surrogates exceeding the upper acceptance limits. However, results for these samples are all non-detect and require no qualification.

Matrix Spikes/Matrix Spike Duplicates

The matrix spike and the matrix spike duplicate results both report recoveries for pyrene which exceeded the upper limit of acceptance, but since none of the samples tested positive for pyrene, no action is necessary. The compounds, 1,4-dichlorobenzene and 2,4-dinitrotoluene, exhibit recoveries within acceptable limits for the matrix spike, but are non-detected in the matrix spike duplicate. The recoveries for these compounds were within acceptable limits at the beginning of the analytical batch as demonstrated by the continuing calibration check and laboratory control sample, and were shown by the matrix spike to be within limits after the last sample was analyzed. If the system did in fact develop a problem with 1,4-dichlorobenzene and 2,4-dinitrotoluene, the problem did not develop until after the last sample was analyzed. Therefore, the quality of data for these samples is not affected.

Regional Quality Assurance and Quality Control

Field duplicates, samples 0210864-14A and -15A, were non-detect for all compounds.

Internal Standards

Internal standard performance for each analysis was within the quality control limits set for each internal standard peak area as well as the retention time when compared to the 12-hour calibration standard.

Target Compound Identification

The only positive results reported for the entire sample delivery group were for n-nitrosodiphenylamine in samples 0210864-03A and -12A. The laboratory did not include mass spectra in the raw data, so identification verification was based upon retention times and q-values. Retention times in both samples match the retention time for n-nitrosodiphenylamine in the associated continuing calibration, and q-values are 94 and 93 respectively. No data qualification is needed based on target compound identification.

Compound Quantitation and Reported CRQLs

Quantitation calculations have been performed in accordance with method specifications.

Tentatively Identified Compounds

Tentatively identified compounds have not been evaluated or reported.

System Performance

Analysis of lcs-16722 and lcs-16722 dup indicated that all spike recoveries and relative percent differences were within QC limits. A subsequent laboratory control sample analysis, lcs-16761, exhibits a high recovery for pyrene due to matrix interference, but none of the samples tested positive for pyrene. System performance is determined to be satisfactory.

Overall Assessment

The overall quality of the data for the semivolatile fraction of this sample delivery group is satisfactory and requires no qualification.

The samples were not tested for atrazine, benzaldehyde, caprolactam, 2,2'-oxybis(1-chloropropane), or 1,1'-biphenyl.

Elevated quantitation levels are the result of matrix issues.

Dioxins/Furans Analysis

For evaluation of data for this project, Potesta & Associates, Inc. utilized the "USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review", EPA-540-R-02-003, August 2002.

Holding Times

Criteria for holding times and storage for all samples have been met.

Field Duplicates

The following table compares the replicate samples 0209606-01A and -10A.

	0210864-14A(pg/g)	0210864-15A(pg/g)	% Difference
2378-TCDD	507	530	4
12378-PeCDD	79	85.9	8
123478-HxCDD	ND	ND	
123678-HxCDD	39.5	36.6	7
123789-HxCDD	ND (18.9)	25.2	29
1234678-HpCDD	ND (170)	181	6
OCDD	1410	1610	13
2378TCDF	42.1	32.7	25
12378-PeCDF	7.8	11.4	38
23478-PeCDF	7.3	7.0	4
123478-HxCDF	ND (30.7)	23.1	28
123678-HxCDF	ND	ND	
234678-HxCDF	ND	ND	
123789-HxCDF	ND	ND	
1234678-HpCDF	70.3	66.1	6
1234789-HpCDF	ND	ND	
OCDF	172	181	5

Mass Calibration and Mass Spectrometer Resolution

Verification has been provided that each instrument involved in these analyses has met resolution requirements of $\geq 10,000$ for perfluorokerosene at the beginning of each 12-hour analytical period.

Window Defining Mix

A window defining mix has been analyzed during each 12-hour analytical period on instruments set up with DB-5 columns demonstrating appropriate switching times for selected ion monitoring time descriptors.

Chromatographic Resolution

Satisfactory chromatographic resolution has been demonstrated on each instrument by the analysis of a column performance solution during each 12-hour analytical period. Instruments set up with DB-5 columns have demonstrated peak separations between the 2,3,7,8-TCDD and 1,2,3,8-TCDD peaks with a valley less than 25 percent of the peak height of 2,3,7,8-TCDD.

Instruments outfitted with DB-225 columns have demonstrated peak separations between 2,3,7,8-TCDF and 2,3,4,7-TCDF with a valley less than 25 percent of the peak height of 2,3,7,8-TCDF.

Instrument Stability

Raw data from the midpoint (C3) standards analyzed at the beginning of each 12-hour analytical period were evaluated with regard to retention times, relative retention times, ion abundance ratios, signal-to-noise ratios, and response. No issues were found which would warrant the qualification of any sample data within this project.

Initial Calibration

The initial calibration of each instrument associated with sample analysis for this project meet criteria set forth by the USEPA regarding resolution, ion abundance, retention time, sensitivity, linearity, concentration, and frequency.

Calibration Verification

Calibration verification has been performed at the beginning of each 12-hour analytical period by the analysis of a midpoint (C3) standard on each instrument involved with sample analysis according to the following criteria: ion abundance ratio, retention time, relative retention time, signal-to-noise ratio, and analyte response.

Identification Criteria

Examination of quantitation summaries and corresponding raw data with regard to compound identification criteria including retention times, signal/noise ratios, and ion abundance ratios indicates that the target analytes have been properly identified.

Method Blanks

Method blanks analyzed with this extraction batch meet all QC criteria, and require no data qualification.

Laboratory Control Samples

Laboratory control samples (ongoing precision and recovery sample) met all acceptance criteria.

Toxicity Equivalency Factor

Toxicity equivalency concentration calculations have been performed correctly.

Dilutions

Samples 0210864-01A, -04A, -05A, -07A, -08A, -09A, -10A, -12A, -14A, and -15A report positive results for 2,3,7,8-TCDD all of which exceeded the calibration range. Sample 0210864-12A also reported OCDD exceeding the calibration range. Dilutions were not run for these samples which require that all of this data be qualified "J".

Second Column Confirmation

Second Column Confirmation was performed in order to confirm all positive results for 2,3,7,8-TCDF.

Estimated Detection Limit

EDLs have been properly calculated and reported.

Labeled Compound Recoveries

Samples 0210864-06A and -10A show recoveries for 13C12-PeCDD-1,2,3,7,8 which are below QC limits. Sample 0210864-09A shows recoveries below QC limits for every internal standard except 13C12-OCDD. All results associated with internal standards below QC limits are "J" qualified. Several samples exhibit ion abundance ratios and S/N ratios which are outside QC limits, however, this does not require qualification. These issues are all the result of matrix interference.

Overall Assessment

Qualified Data is summarized as follows:

Results for 2,3,7,8-TCDD in samples 0210864-01A, -04A, -05A, -07A, -08A, -09A, -10A, -12A, -14A, and -15A are "J" qualified.

Result for OCDD in sample 0210864-12A is "J" qualified.

Results for 1,2,3,7,8-PeCDD in samples 0210864-06A and -10A are "J" qualified.

All data for sample 0210864-09A are "J" qualified except OCDD which requires no qualification.

Elevated quantitation levels are the result of matrix issues.